MICROANALYSIS AND FUNCTIONAL TYPOLOGY OF THE HOGUP CAVE CHIPPED STONE TOOLS

by

Henry Gerald Wylie

A thesis submitted to the faculty of the
University of Utah in partial fulfillment of the requirements
for the degree of

Master of Arts

Department of Anthropology

University of Utah

December 1973

UNIVERSITY OF UTAH GRADUATE SCHOOL

SUPERVISORY COMMITTEE APPROVAL

of a thesis submitted by

Henry G. Wylie

I have read this thesis and have found it to be of satisfactory quality for a master's degree.

Oct 18 '73

Date

Jesse D. Jennings
Chairman, Supervisory Committee

I have read this thesis and have found it to be of satisfactory quality for a master's degree.

18 October 1973

Date

Philip C. Hammond
Member, Supervisory Committee

I have read this thesis and have found

degree.

18/IX/73

Date

John M. McCullough
Member, Supervisory Committee

UNIVERSITY OF UTAH GRADUATE SCHOOL

FINAL READING APPROVAL

To the Graduate Council of the University of Utah:

I have read the thesis of Henry G. Wylie in its final form and have found that (1) changes suggested by the Supervisory Committee have been completed in the manuscript; (2) reference citations and bibliography are consistent and in an acceptable form; (3) all illustrative materials including figures, tables, and charts are in place; and (4) the final manuscript is satisfactory and ready for submission to the Graduate School.

Oct 18 '73

Date

Jesse D. Jennings

Member, Supervisory Committee

Approved for the Major Department

Seymour Parker

Chairman/Dean

Sterling M. McMurrin

Graduate Dean

ACKNOWLEDGEMENTS

I would like to thank Dr. Jesse D. Jennings, my Supervisory Committee Chairman, whose personal hypotheses concerning the actual use of certain Great Basin tool forms originally led me onto this topic, and whose active interest and constructive criticisms sustained me throughout the months of this study. Thanks are also due to the other members of my Supervisory Committee, Dr. Phillip Hammond and Dr. John McCullough for their advice and editorial comments.

The generous support received through a National Science Foundation Graduate Traineeship is also greatly acknowledged.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES- CONTINUED

ABSTRACT

One thousand prehistoric chipped stone tools from Hogup Cave, Utah were analyzed microscopically for use-wear evidence. The study sample included all whole, identifiable tools plus a representative portion of the utilized flake and unutilized or "waste" flake categories originally recovered from the site. These materials include such descriptive tool forms as projectile points, scrapers, biface blades, crude unifaces and crude bifaces, spokeshaves and choppers. They range in age from 8300 to 500 years B.P. (6400 B.C.-A.D. 1470) and relate to the Desert Archaic, Fremont and Shoshonian occupations of the site.

The tool microwear observed was interpreted by comparison with experimentally reproduced and tested tool specimens. Nine specific types of tool activity were recognized along with their probable contact materials. These include: <u>hard scraping</u> of wood and bone; <u>soft scraping</u> of hides; <u>carving</u> of wood and meat; <u>sawing</u> of wood and bone; <u>chopping</u> of wood and bone; <u>adzing</u> of wood; <u>projectile impact</u> with soil, stone and animal bone; <u>drilling</u> of wood; and <u>awling</u> of hides. Of these, the dominant component in the Hogup Cave functional complex is sawing(50%), followed by soft scraping(20%) and carving(10%). The remaining functions are less common and in the aggregate constitute less than

one-fifth of all microwear observed in the collection.

Thirteen tentative functional tool types are suggested and defined. Based on observed microwear and descriptive criteria, they are offered in an attempt to add a new dimension to the traditional view of artifact classification. They include: Simple Projectile Points(281), Projectile Saw/Knives (119), Flake Saw/Knives(80), Flake Hide-scrapers(71), Biface-blade Saw/Knives(62), Hide-scraper/Saws(35), Biface Blanks(23), Adzes(19), Drills(17), Simple Hard Scrapers(16), Hogup Saws(7), Choppers(6), and Awl/Perforators(1). Seventy-four per cent of the 1,000 artifacts analyzed are conveniently categorized by this system, and the remaining 252 pieces are without wear or are nondiagnostic with respect to form or function.

This study concludes that tool function cannot always be correctly inferred from stylistic criteria alone, and a system of tool classification based solely on morphology is less meaningful if functional criteria are not utilized.

CHAPTER I

INTRODUCTION

Purpose of the Study

Since the translation of Semenov's pioneering work on the microscopic examination and functional interpretation of European Paleolithic stone and bone tools in 1964, investigators have refine and adapted the techniques of functional microanalysis to New World materials with considerable success. However, there has been no attempt to apply such techniques to Desert culture artifacts of western North America. The purpose of this study, therefore, is to assess the applicability of these methods to the study of Great Basin chipped stone materials.

It is hoped that at least two principal questions may be answered:

(1) Can Great Basin lithic materials be shown to exhibit use-wear features similar to those described by Semenov and others, and

(2) Can these features be correlated with specific functional activities?

If the examined artifacts are shown to exhibit surface microwear, and these features can be conclusively related to specific tool activities, it should be possible to arrive at the functional classification of aboriginal tools.

Approach

In order to evaluate the usefulness of a functional approach to the study of Great Basin chipped stone materials, a survey of previous research efforts was undertaken. Here Semenov's work (1964) provided a wealth of practical information. The literature which has grown up around functional studies since Semenov's original work reveals a body of material which is diverse, experimentally oriented, and often highly technical in nature. Such topics as microscopic technique, experimental tool production and application, ethnoarchaeology, physical properties of stone structure and artifact flaking, and the biomechanic principles of human tool using all find their way into the discussion of the types, processes and ultimate functional identification of aboriginal tool microwear.

There are, however, certain methodological weak spots in many of the existing functional studies. The major problems are summarized by criticisms from Thompson (Semenov's translator-1964), Bordes (1969) and others:

(1) The selection of overdramatic and non-representational specimens, and a concomitant lack of statements as to the actual frequency of each type of microwear feature observed in the sample.

(2) An overemphasis on the investigation of "classic" tool

types, such as end-scrapers, knives, axes, etc., to the almost total exclusion of the minor elements of the lithic assemblage, such as the utilized flake or debris categories. (3) A lack of supplemental experimental and ethnographic data to support the functional interpretations developed.

To avoid the problems of subjective artifact selection and emphasis in the present study a complete chipped stone tool assemblage was examined, including a representative random sample of the utilized and waste flake categories. Additionally, precise tabulations were utilized in order to assess the relative occurrence of each microwear feature, and information gained by testing of experimentally reproduced stone tools against hide, bone and wood materials was used to interpret the use-wear evidence isolated by microscopic surface examination of the aboriginal implements. Ethnographic data were not utilized.

CHAPTER 2

SITE AND COLLECTIONS

The Site

Hogup Cave is located on the dry, desolate northern perimeter of the Great Salt Lake Desert, about 60 miles northeast of Danger Cave and 75 miles northwest of Salt Lake City, Utah. The findings have been reported by Aikens (1970).

Coprolite analysis and other data indicate that seasonal occupation of the site occurred during the late summer and early fall months (Fry 1970), probably for the harvesting of the pickleweed crop (*Allenrolfea occidentalis*) which grows at the margin of the salt flats. Although other plant and animal resources were exploited from this base camp, it is clear that the vicinity of the site could not have supported a year-round occupation (Aikens 1970:196).

The Collections

A total of nearly 10,000 cultural items were recovered from the site. Due to the extremely dry conditions of the cave interior, many artifacts of an otherwise perishable nature were preserved intact. Artifactual materials include objects made of ground, pecked and flaked stone, worked bone, horn, shell, hide, feathers, wood and plant fiber.

The accumulation of this cultural debris in the 14 feet of cave fill represents a span of nearly 8,000 years (6400 B.C. to A.D. 1470), during which time the cave was occupied by a succession of Desert Archaic, Fremont and Shoshoni hunting/gathering peoples. However, the tool sample examined in the present study was viewed as a single technological unit associated with an essentially uniform Desert culture adaptation, and no effort was made to segregate the specimens or organize the use-wear evidence according to age or cultural affiliation.

The chipped stone materials include projectile points, blades, choppers, crude bifaces and unifaces, spokeshaves, drills, and scrapers. There was a total of 5450 chipped stone items recovered, including complete tools, tool fragments and over 3,000 pieces of flake detritus. 1,000 of these artifacts were analyzed. Excluded from the present analysis were specimens on loan to other institutions and tool fragments which could not be positively identified. In addition, 23 per cent of the retouched flake (100 of 425) and less than 3 per cent of the total flake detritus categories (100 of over 3,000) were examined.

Chert, chalcedony, ignimbrite (welded tuff) and obsidian are the principal lithic materials represented in the collection. Tools of basalt, quartzite and various sedimentary materials are present only in minor amounts. The presence of numerous chert, chalcedony and ignimbrite quarry sites in the nearby Raft River and Grouse Creek mountains (Wylie 1970) and the results of trace element studies on obsidian and ignimbrite (Condie and Blaxland 1970) suggest that most of the raw materials used in the production of Hogup Cave tools came from the northwest corner of Utah and adjacent portions of Nevada and Idaho.

CHAPTER 3

METHODOLOGY

Equipment

A variable-power binocular dissecting microscope with a maximum magnification of 50X was used to inspect all artifact surfaces. Binocular instruments of this sort are well suited for microwear analysis because they produce very little eyestrain, provide a wide depth of field (focus) at low power, and have a range of magnification suitable for observing different types and sizes of microwear. The Wild-M5 stereoscope used in this study was slightly less powerful than that used by other researchers, but this was not a serious handicap. It was found that the use of the highest power available (50X) was time consuming and frequently resulted in problems of artifact stability and restrictive depth of field. The benefits of low-powered work are speed, and ease of operation, factors which are critical when working with large numbers of specimens. The magnifications most often used in this study were those between 10X-40X.

Observation

Each of the 1,000 specimens were subjected to a thorough microscopic examination. For the larger and more complex artifacts this systematic surface micro-survey took as much as 30 minutes each, although the average inspection time was probably under 10 minutes per specimen for most of the collection. A low-powered scan was first conducted to reveal gross features of manufacture and use-wear, and to locate areas of particular interest. These zones were then observed at successively higher magnification until their exact character could be determined.

For all except the most powerful close-up work the specimens were hand-held. In this way, the artifact surface could be easily manipulated to catch the necessary amount and proper angle of reflected light needed to reveal subtle wear features. The adjustment of a clamp-held artifact was very limited and time consuming in comparison. By using modeling clay some of these problems could be overcome, but the minute greasy streaks imparted by this method tend to obscure (or even be mistaken for) surface use-wear features.

When plant fibers or other organic debris were encountered on the tool surface, a simple glycerine slide was usually made and a sample observed with a higher-powered microscope (up to 500X) to determine its nature.

With some especially glossy surfaces the application of a thin film of diluted india ink was used to bring out surface features otherwise masked by intense reflected light. This ink treatment also proved useful for the highlighting of subtle wear features on transparent stone surfaces.

All observations made on each artifact were noted and discussed on a Microanalysis Artifact Data Sheet (see Appendix I), including such information as lithic material, method of manufacture, edge working angle (measured with a goniometer), and a full-sized sketch showing all use-wear as it appeared on the actual tool. From these data sheets information was later tabulated and organized without having to handle the artifacts more than once.

Experimental Replication

The purpose of the experimental phase of the study was to attempt an empirical determination of the types of microwear associated with known technological activities. In this phase, an attempt to reproduce the natural conditions surrounding these activities, stone tools patterned after those found at Hogup Cave were worked against an assortment of fresh wood, bone and hide surfaces. The animal hide used was that of a freshly killed and skinned deer and contained considerable amounts of fat, meat and membranous tissue. To approach the state of natural contamination due to skinning such an animal on the ground, and to test the effects of natural soil abrasives on tool use surfaces, the moist and sticky flesh side was sprinkled with varying amounts of sand. For the wood sample, hard and soft specimens --oak, greasewood, willow and pine-- were collected from the Salt Lake area.

After these various test materials were vigorously scraped, chopped, adzed, sawed, or carved, the utilized tool edges of each artifact were examined for microwear. In this way approximately 60 tools were obtained representing the major primitive tool activities at the site. Aboriginal tools displaying microwear were then compared with these type specimens to establish, it was hoped, their original function(s). This approach is essential to the inexperienced investigator new to functional studies as well as the expert who is unfamilar with the local variables. This is important because tool design, lithic type, and the cultural or technical motor habits peculiar to each region or site locality appear to produce different patterns of tool microwear in each situation.

CHAPTER 4

MICROWEAR ELEMENTS

Microwear elements are those minute use-scars produced on the surface of a stone tool by contact with another substance. The use-scars of a tool working edge constitute the smallest unit of study in any functional examination. Thirteen different categories of microwear have been identified from the Hogup Cave sample. The presence of these features in various combinations and contexts enables us to estimate the original functions of each stone tool. Since these are the building blocks of functional interpretation, it is important to consider some of the facts surrounding their formation, observation and identification on stone tool surfaces.

Formation

The type, intensity and location of microwear elements depends upon a combination of the following variables:

Stone type

Tool edge character

Nature of the worked material

Manner of tool use

Presence of abrasive or polishing agents

Natural agencies

Accident

A brief discussion of each of these points follows.

Stone Type

Although some scientific study of the physical properties of stone tool materials has been attempted (Goodman 1944), very little attention has been focused on the relationship of these properties to problems of primitive technology or the tool microwear which is produced by such activities. In an attempt to consider this latter topic, a tentative outline of the relationship of stone types to the production and visibility(observation) of microwear is offered. Fig. 1 indicates that glassy and fragile types such as obsidian and ignimbrite (welded tuff) generally display greater wear than the more resistant and rougher textured crypto-crystaline materials. They have softer and more easily scratched surfaces, and frequently, very sharp, thin use-edges which are particularly vulnerable to attrition. Furthermore, any use-wear which blemishes the fresh, smooth surface is readily observed microscopically on these types whereas the tougher and harder cherts, jaspers and quartzites not only resist wear, but because of their rough crystaline surfaces, wear is less visible to inspection.

LITHIC MATERIAL \ QUALITIES	RESISTANCE TO WEAR	SURFACE TEXTURE	RELATIVE WORKABILITY	TOTAL MICROWEAR VISIBILITY
Ignimbrite	very poor	vitreous and smooth	good	very good
Obsidian	poor	vitreous and very smooth	very good	very good
Chalcedony	fair	fairly smooth	fair	good
Chert	good	rough	fair	fair
Jasper	very good	rough	poor	poor
Quartzite	good	very rough	very poor	very poor

Fig. 1. Relationship of stone types to the production and visibility of tool microwear.

Edge Type

Microwear is easier to see on an unmodified flake edge than on a tool with a flaked edge because there is less confusion between intentional retouch and unintentional wear features. Furthermore, an irregular tool edge, such as that produced by retouch, usually displays less noticeable wear than a comparable unmodified tool edge. Because of reduced or imperfect edge contact with the worked material, friction and wear are concentrated on the small edge-protrusions. In most cases this intensification merely results in localized edge wasting and a loss or masking (rather than an increase) of most types of microwear. Consequently, an unmodified flake will usually show more evidence of wear than a bifacially flaked tool with a similar edge angle.

The strength of the tool edge is also critical in wear formation. Experiments show that thin working edges suffer rapid and severe attrition, especially during hard sawing activities. The attrition debris detached from the tool edge during this process then become imbedded in the worked material and act as an abrasive agent to further modify the tool edge. Tools with stronger edges better resist this type of self-wear. This is particularly true of bifacial artifacts because this type of flaking tends to produce a less acute edge than most unifacial techniques (Fig. 2).

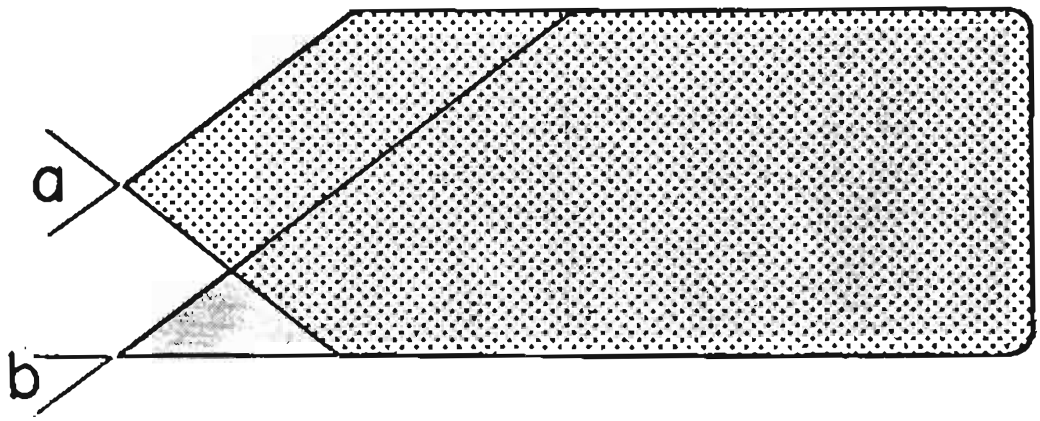

Fig. 2. Difference of acuteness in edges produced by bifacial (a) and unifacial (b) flaking techniques.

Nature of the Worked Material

Semenov (1964) has suggested that the physical properties of the worked materials can affect the type, intensity and location of tool microwear. His arguments are reasonable but hypothetical, and have not been substantiated by extensive experimental or ethnographic testing. An experimental test program has been recently proposed by Shiner (personal communication) and would include tests of the following Semenov hypotheses:

(1) A soft material such as meat would produce polish on a knife not only on the high spots but in the concavities as well; a harder material like wood should polish the convexities only.

(2) An endscraper used on a hide will leave wear patterns distinct from those left by using it on wood, and distinct again from scraping bone.

(3) Projectile points with burin-plan facets at the tip are probably impact breaks, while snaps at the center are probably manufacturing breaks.

The results of Shiner's tests are not yet available, but both the experimental type collection and Hogup Cave chipped stone specimens support Shiner's predictions.

Manner of Tool Use

The experimental type collection data also support the notion that tool application (force, angle of attack, motion, duration and amount of edge contact) also contributes heavily to the production of distinctive tool wear. Also of importance is the use of anvils or bases for the support of the worked object, a point closely related to tool application which has not been adequately emphasized in discussions of wear production. Experimental studies in primitive technology (Hester and Heizer 1972; Crabtree and Davis 1968) reveal that accidental contact between tool and stone anvil can result in extensive (and sometimes the only) wear to the working edge.

Abrasive or Polishing Agents

In the production of striae and surface lustre, the principal cause of tool wear is the presence of abrasive or polishing agents such as sand or silica. Since stone can only be scratched by a harder substance, no skin, wood, or bone materials can, by themselves, cause tool striation. Only the presence of sand particles on such materials produces this type of wear. Grit on hide and other worked surfaces will cause considerable scraper edge abrasion, and a dirty hand will, over time, produce polish on the surfaces of hand-held implements. Additionally, since it is known that the stems of many types of plants contain natural silica particles or "phytoliths" (Rovner 1971, Twiss and others 1969), the edges of any siliceous tools used to harvest or modify these plants can be expected to accumulate a very distinctive "gloss" of fused opal (Witthoft 1967).

Natural Agencies

The role of natural agencies in the production of tool wear should always be considered when dealing with open site collections. The problem of artifacts churned and accidentally "worn" in dynamic soil conditions need not be treated here since the factor is not present in the Hogup Cave materials. It is necessary, however, to mention that a great deal of natural wear such as stream tumbling of the parent material may be retained on the parts of chipped stone tools where flaking has not removed all traces of the original cortex surface. Therefore, in any study care must be taken to recognize such surfaces and to isolate this factor.

Accidental Wear

Another poorly understood and little-studied factor of wear production on stone tools is the affect of accidental post-recovery attrition. From recovery, through transport, processing and analysis to final storage, each artifact may suffer scores of minute flake scars. For example, one completely hydrated obsidian projectile point from the Hogup collection has no fewer than 40 fresh flake scars along its margin, all of which were received sometime after deposition and surface hydration. Dozens of these detached attrition flakes can be found in the bottom of artifact storage bags, especially in situations where the tools are large or their edges thin. Such tool scars can easily be mistaken for genuine use-wear features. Evidently more care should be accorded flint specimens.

Preservation and Observation

The identification of any microwear feature generally depends on the condition of the tool surface at recovery. Physical and chemical deterioration such as patination, hydration, sand blasting, water rolling, and heat cracking will obscure all but the heaviest of surface features. Multiple functional activities and the overlaying of different wear patterns will also tend to confuse identification. In addition, the aboriginal practice of regularly resharpening dull tools removes a large portion of the previous wear evidence. Although Frison (1968) has shown that such data are not necessarily lost, special precautions and techniques are required for recovering these minute resharpening flakes.

Listing of Microwear Elements

Following are those microwear patterns which have been observed on Hogup Cave specimens and, in part, functionally identified by controlled experimentation with similar tools and materials. Tool edge terminology is presented in Fig. 3.

Christie Striae

Description: A pattern of short, parallel scratches at right angles to the tool edge (Fig. 4a).

Location: The immediate tool edge and frequently the dorsal edge margin, especially when the edge angle value of the artifact approaches 90°. Christie striae may also involve a slight beveling of the ventral lip of the tool edge.

Replication: These features are easily reproduced on various stone types by scraping the tool over a sand encrusted deer hide. Little or no striae are produced without the presence of sand particles.

With the more resistant lithic types such as chert and chalcedony, greater amounts of grit and tool pressure are needed to produce these edge-perpendicular scratches.

A severe variety of christie striae can be produced by scraping the tool edge against a rough stone surface.

Implied Activity: A one-way edgewise scraping movement toward the operator, such as the scraping of animal hides. For the more severe, and less common variety, intentional edge dulling may be implied.

Note: Christie striae are almost always associated with edge abrasion. The term "christie" is taken from a common maneuver in skiing involving a sideways slipping of the ski.

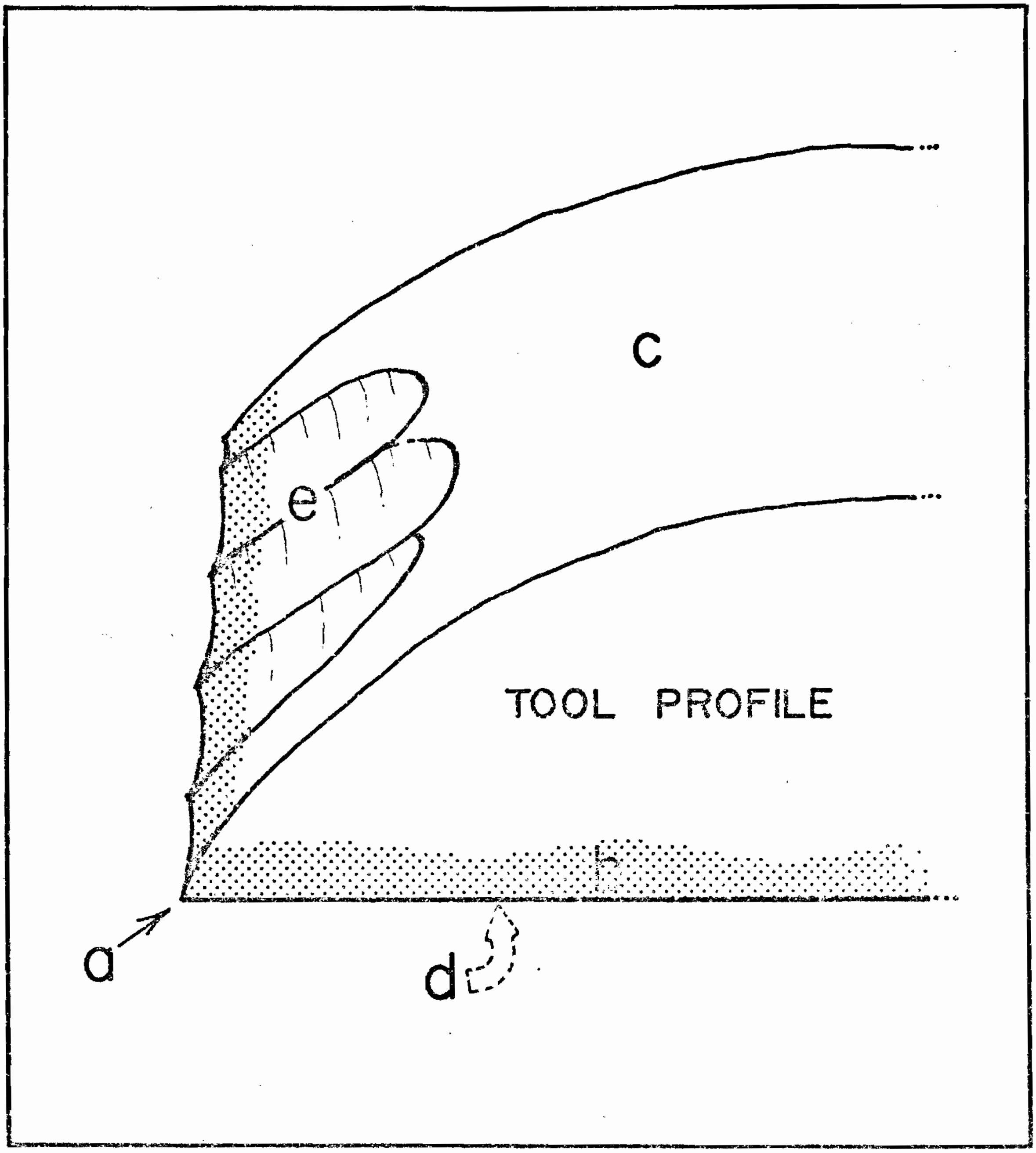

Fig. 3. Brief tool edge terminology. a; immediate tool edge; b, "lip" or margin immediately adjacent to the tool working edge (1-5mm wide); c, dorsal face or surface; d, ventral face or surface; e, flake scar ridge.

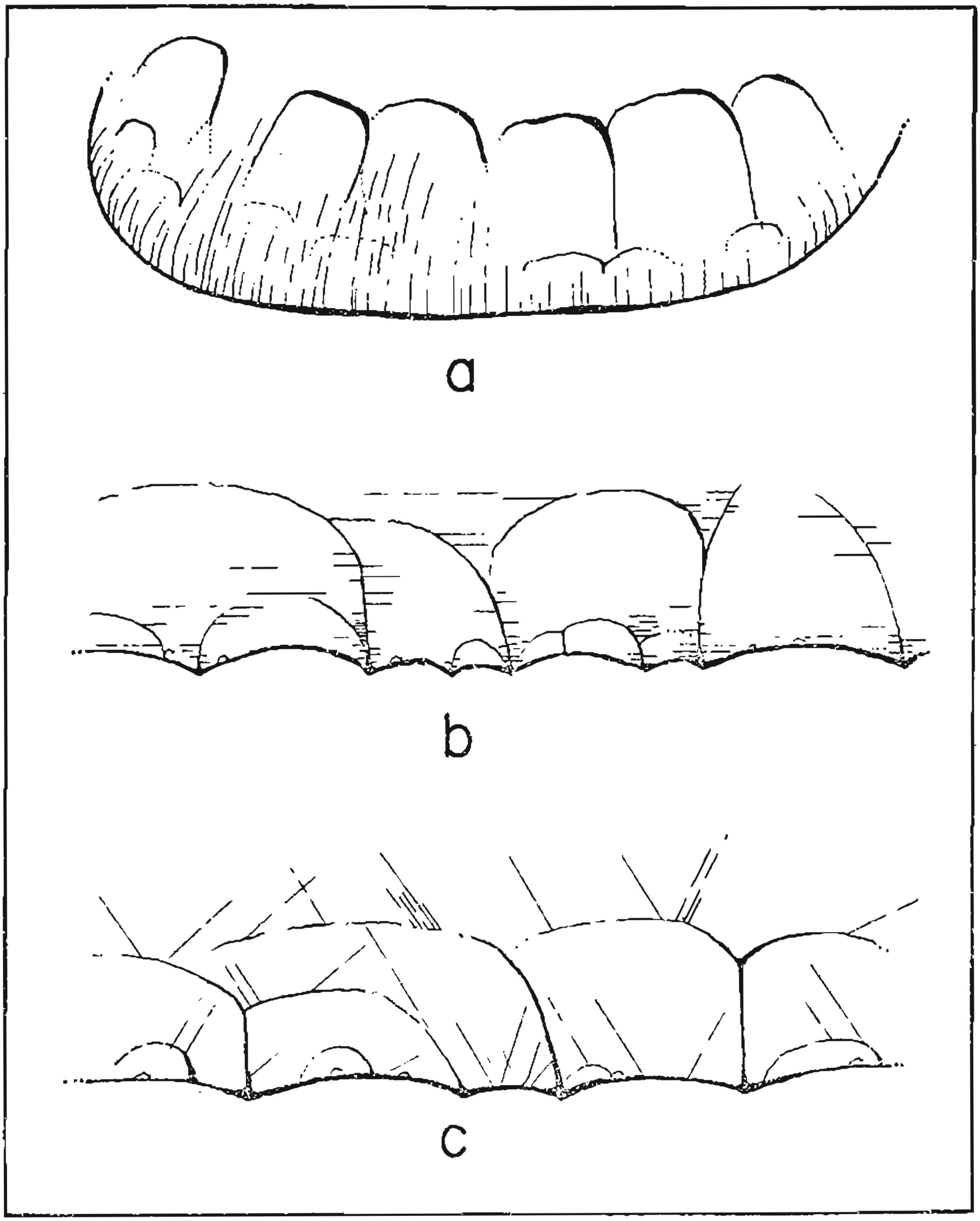

Fig. 4. Three common forms of tool edge striation. a, christie striae produced by hide scraping; b, edge-parallel striae produced by sawing activities; c, oblique striae from carving tasks.

Edge-parallel Striae

Description: A series of long scratches which are parallel to and concentrated along the tool working edge, especially on the flake scar ridges perpendicular and immediately adjacent to the tool margin (Fig. 4b).

Location: Margins(bifacial), edges(rare), faces(rare).

Replication: One- or two-way sawing motion on bone and wood surfaces.

Implied Activity: Sawing of wood or bone.

Oblique Striae

Description: Scratches on the tool surface which begin at the edge and trend into the body of the artifact at an acute angle (usually between 30°-50°; see Fig. 4c).

Location: Margins and faces, usually bifacial.

Replication: None

Implied Activity: Because of the slanting character of these striae, the tool edge had to have been either used at a low working angle to some gritty surface, or else it deeply penetrated a soft, dirty substance with a sawing motion: perhaps for carving (whittling) wood or for cutting meat.

Note: This type of microwear can very easily be confused with impact striae on some projectile points.

Edge Abrasion

Description: The dulling or beveling of an otherwise sharp tool edge; usually slightly asymmetrical in cross section and with greater attrition on the dorsal lip of the tool.

Location: Typically on the immediate edge of a steep, unifacially flaked tool, and also on the high spots of the dorsal margin immediately adjacent to this edge.

Replication: A one-way scraping of sandy deer hide.

Implied Activity: Hide scraping (flesh side).

Light Polish

Description: Artifically smoothed and shiny areas of the tool surface and working edges.

Location: Edges, margins, faces.

Replication: Produced on the tool edge and ridges of flake scars adjacent to the working edge during sawing of wood and bone. However, simple sawing activities account only for the edge and margin varieties of this microwear feature.

Implied Activity: Sawing of wood or bone, and possibly handling wear.

Note: Semenov has stated that many such light gloss zones are actually composed of a large number of very fine scratches on the tool surface. This fact could not be verified, perhaps due to the character of the stone surface or the lack of a more powerful microscope.

Super Lustre

Description: Brilliant surface shine, usually with some liquid-like "flow" features.

Location: Edges, margins, surfaces(rare), usually unifacial.

Replication: Limited success was achieved by scraping plant stems containing opal phytoliths.

Implied Activity: One-way scraping or perhaps cutting of certain plant types (reed or cane stalks?).

Note: Similar to "corn gloss" features discussed by Witthoft (1967).

Edge Spall/Nicks

Description: A dull, scalloped tool edge produced by irregularly spaced concave snap scars with no concoidal flake features.

Location: Tool edges only, especially those which are thin and fragile.

Replication: Rough sawing of wood and bone with a thin, fragile-edged implement. Particularly evident with obsidian and ignimbrite tools.

Implied Activity: Sawing of wood or bone.

Burin Faceting

Description: Severe edge-dulling produced by the removal of as many as four flat, burin-like edge spalls. The average maximum dimensions of these flat or concave facets are 15 x 2mm The larger examples obliterate as much as 50mm of the artifact edge.

Location: The majority of these elements are located on the tips of projectile points, although a few (5) were found on the margins of certain flake saws.

Replication: None

Implied Activity: Burin-like facets on the tips of projectiles are probably the result of accidental impact, and their presence on sawing implements may be indicative of intentional dulling procedures (tool backing).

Note: For further discussion see "projectile impact" in chapter 5, and "tool backing-dulling techniques" in chapter 6.

Pitted-dulling

Description: A small-scale surface deterioration, found only on tools made of obsidian or ignimbrite, where the usually bright, smooth surface assumes a pitted and dull texture.

Location: Edges and margins.

Replication: Scraping of a heavily sanded animal hide.

Implied Activity: Any scraping task which would involve large amounts of grit or repeated contact with the ground.

Battered-dulling

Description: Edge destruction by heavy battering. The most extreme variety of tool wear observed in the collection, consisting of large amounts of percussion-impact features such as fracturing, pulverization and large step-fractured and concoidal flake scars.

Location: Edges and adjacent margins.

Replication: None

Implied Activity: The percussive nature of these features clearly indicates that some form of heavy pounding or chopping activity was involved. The modified materials were probably wood or bone, perhaps with some or all of the tool wear produced through accidental contact with the ground or an underlying stone anvil.

Step-Fracture Flake Scars

Description: Small (usually less than 5mm) attrition flake scars that terminate abruptly in a step or hinge-type fracture.

Location: Nearly always unifacially situated on a steeply angled tool edge

Replication: Two methods were found to be successful: (a) one-way scraping of wood and bone produced a large number of small (less than 1mm) hinged scars on the side of the edge opposite the direction of tool travel, and (b) low angle adzing or chopping of fresh wood surfaces yielded a small number of larger hinge fractures which began at the working edge and extended back along the ventral or contact surface for at least 5mm.

Implied Activity: Scraping of wood or bone, or chopping/ adzing of wood and perhaps bone surfaces.

Note: In other studies similar tool microwear features are known to be associated with wood scraping (Crabtree and Davis 1968) and wood adzing activities (Gould, Kostes, Sontz 1971).

Concoidal Flake Scars

Description: Small (less than 1mm) concoidal flake scars which are frequently asymmetrical in outline.

Location: Both sides of the immediate tool edge.

Replication: Two-way sawing of wood and bone. Similar scars, however, are produced accidentally in storage and/or transport, through contact with neighboring tools.

Implied Activity: Sawing of wood or bone.

Impact Striae

Description: A series of long scratches generally parallel to each other and to the long axis of the artifact.

Location: Impact striae cover both surfaces of some projectile points and are typically concentrated on those flake scar ridges or other surface convexities which face towards the direction of artifact travel.

Replication: None

Implied Activity: Deep penetration of a very abrasive but soft substance, such as the impacting of a spent projectile into soil.

Note: This feature is unique to projectile points and may sometimes be confused with oblique-carving striae.

CHAPTER 5

CATEGORIES OF FUNCTIONAL ACTIVITIES

Types of Activities

From the examination of tool microwear evidence; modified wood, bone and hide remains; and the results of experimental testing, it is evident that the chipped stone tools from Hogup Cave were used to accomplish a variety of scraping, cutting, percussion and penetrating tasks. These four basic areas of technological activity can be further broken down into nine specific functions, each characterized by a different type and/or combination of microwear elements. These include such activities as hard scraping of wood or bone, soft scraping of animal hides, carving, sawing, chopping, adzing, projectile impact, drilling, and awling. Fig. 5 illustrates the relationship of these functions to the worked materials and to the principal kinds of tool microwear produced in each case. Note also the peculiar status of "projectile impact"; it is here treated as both a percussive and penetrative activity.

Comparison of Functional Categories

A total of 573 functional units are identified for the Hogup Cave sample. Each is representative of a specific

GENERAL ACTIVITY	SPECIFIC FUNCTION	MODIFIED MATERIALS	TYPICAL MICROWEAR ELEMENTS
Scraping	hard	wood, bone	step-fracture flake scars, super lustre
	soft	hide	christie striae, light polish, edge abrasion
Cutting	carving	wood, meat	oblique striae
	sawing	wood, bone	parallel-edge striae, concoidal flake scars, edge spall/nicks, light polish
Percussion	chopping	wood, bone	heavy step-fractures and edge dulling
	adzing	wood	step fractures, abrasion, polish
	projectile impact	soil, stone and bone contact	impact striae, burin faceting
Penetration	drilling	wood	christie striae, light edge polish
	awling	hide	parallel-edge striae

Fig. 5. The nine functional activities identified for the Hogup Cave tool sample and their relationship to modified materials and tool use-wear.

activity, and for implements used for multiple tasks, two and even three different microwear patterns can be isolated. Fig. 6 presents the distribution of these functional data in terms of the per cent of each activity identified in the Hogup sample. It clearly shows that the dominant component is sawing (50%), followed by soft scraping (19.5%) and carving (10.3%). Projectile impact, hard scraping, chopping, adzing, drilling, and awling functions are relatively minor elements of the total Hogup Cave functional complex, and in the aggregate constitute less than one-fifth of all functional units observed and identified.

As a precise measure of human behavior, however, Fig. 4 is inadequate because it fails to take into account the variables of microwear production discussed in chapter 4; that is, factors of differential production, destruction or obliteration, and identification of lithic microwear in relation to the differences in edge design, tool application, and stone type. Therefore, these percentages do not necessarily represent the relative importance or actual frequency of each activity, but are merely a convenient, relative comparison of those microwear features observed. For example, although there is much more evidence of sawing activities, simple unmodified flake saws were probably dulled and discarded at a much faster rate than hide scrapers which suffer less edge attrition and may also be resharpened and used repeatedly.

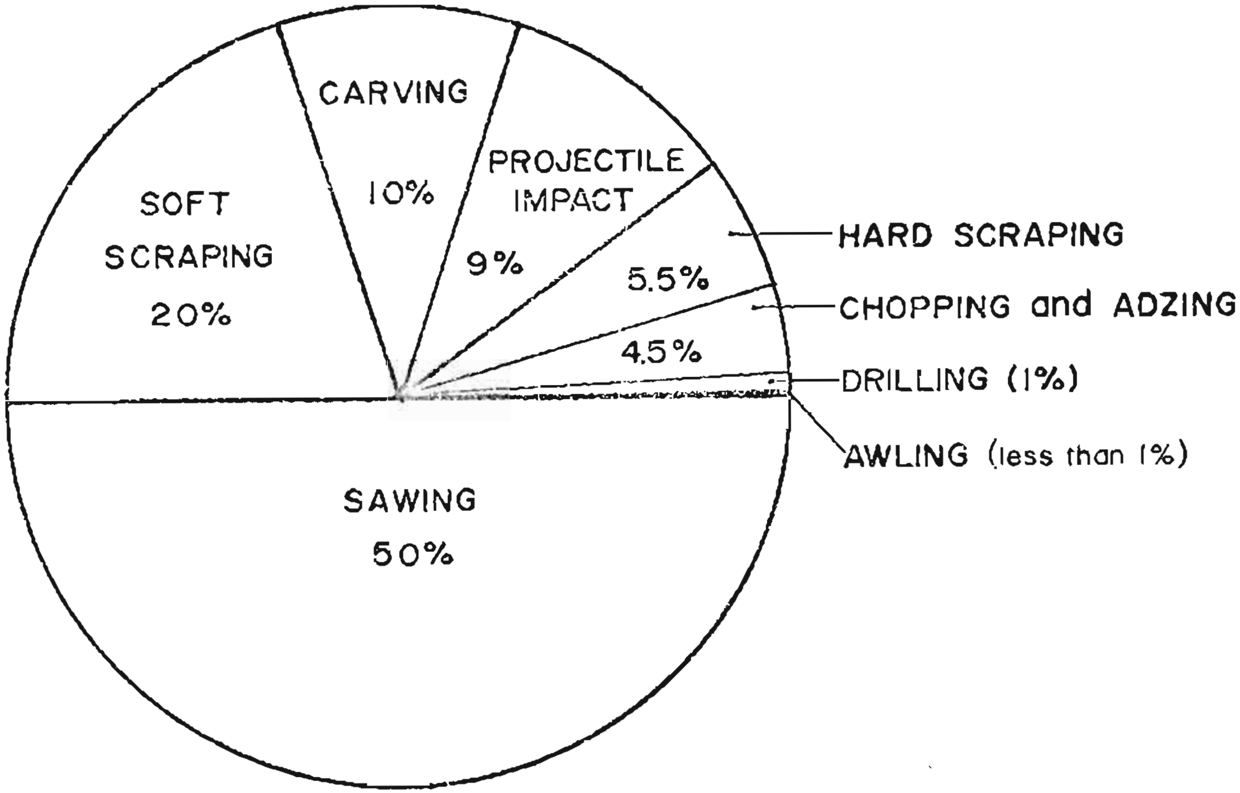

Fig. 6. The relative composition of the Hogup Cave functional complex in terms of the nine categories of tool use observed and identified.

Profile of Functional Categories

Each of the nine specific functional categories has a unique set of physical tool parameters in terms of different tool types, compound wear, lithic material preference and mean edge angle associated with that activity (Fig. 7). The following is a brief discussion of these data plus some interpretations of the possible motor activities involved with each task.

Hard Scraping

Hard scraping activities are characterized by very steep edge angles (70°-85°; mean 75°) on unifacial or unmodified flakes. Ignimbrite and chert are the predominate lithic types, and sawing is the principal co-occurring function associated with hard scraping tools. These activities probably involved the surface modification of wood and bone items by the application of downward force and by drawing the sharp-edged tool toward the operator in a one-way scraping motion. In this way, small step-fractured use flakes were removed from the dorsal side of the implement. Scraping contact with plant opaline (silica) structures could account for the extreme edge gloss encountered on some specimens. Common reed grass (Phragmites), which was used extensively as a raw material for arrow shafts at the site, is a likely candidate for the origin of these fused silica features.

			COMPOUND WEAR AND SURFACE FEATURES								LITHIC TYPE					
		NO. OF MICROWEAR ELEMENTS	HARD SCRAPING	SOFT SCRAPING	CARVING	SAWING	CHOPPING and ADZING	IMPACT STRIAE	EDGE BURINATION	HAFTING STRIAE	CHERT	CHALCEDONY	IGNIMBRITE	OBSIDIAN	OTHER	MEAN EDGE ANGLES
FUNCTIONAL CATEGORIES	HARD SCRAPING	32		3	2	11	-	1	4	1	11	1	13	6	1	75
	SOFT SCRAPING	112	3		1	35	3	-	-	-	81	11	5	-	15	68
	CARVING	59	2	1		36	2	4	-	6	4	1	40	12	2	48
	SAWING	287	11	35	36		4	18	7	33	101	8	117	40	21	47
	CHOPPING/ADZING*	26	-	3	2	4		5	3	2	17	4	2	3		73
	DRILLING	5	-	-	-	-	-	-	-	-	5	-	-	-	-	
	AWLING	1	-	-	-	-	-	-	-	-	1	-	-	-	-	
	PROJECTILE IMPACT STRIAE	34	1	-	4	18	5		5	14	-	-	20	14	-	
	PROJECTILE IMPACT BURINATION	17	2	-	-	5	2	5		3	2	-	5	5	-	
	TOTAL	573														

*excludes 9 projectile points with percussion features

Fig. 7. Partial profile of Hogup Cave chipped stone tool functional categories.

Soft Scraping

Soft scraping functions are associated with fairly steep edge angles (65°-80°; mean 68°) on the ends and sides of long unifacially worked flakes, although a few broken projectile points, bifacial blades and small plano-convex "domed scrapers" were also used for hide scraping. As with hard scraping and carving tools, sawing functions are by far the most common compound activity.

The part of the animal hide worked during this particular activity was undoubtedly the flesh side, where bits of fat, meat and membrane, covered with grit, remained from the skinning operation. This sand may have been either accidental, which is reasonable to expect from having been processed on the ground, or perhaps a purposeful element of the aboriginal curing process as suggested by Wilmsen (1968:159).

For soft scraping, the direction of tool use in all cases was toward the operator with a pulling motion similar to that of hard scraping. Such a pulling action was most likely facilitated by a high working angle and a grip which placed the operator's thumb pointing downward on the side of the tool facing the direction of travel. As noted elsewhere (Semenov 1964:87), a slight tendency toward "right-handed worn" end-scrapers was observed.

During use these scraping tools would have been pressed deeply into the pliable and abrasive surface of the worked skin, resulting in extensive wear along the dorsal edge. The contact edge would then become dulled by the action of sand particles, and polish and edge-perpendicular striae would form as far as 5mm over the back of the implement.

Carving

Carving tasks, involving tools with a mean edge angle of 48°, are second only to sawing functions in terms of low edge angles. This apparent selection for cutting ability is further reflected in the choice of sharp, vitreous stone types in 88 per cent of the carving tools. These implements take the form of bifacial blades, projectile points and simple unmodified flakes, and sawing activities are the principal compound function observed.

As illustrated in Fig. 8, there are two kinds of motor activities which could produce the oblique striae characteristic of carving functions:

(1) a unidirectional, low-angle attack with the tool margin applied diagonally to the worked surface, as in wood whittling, or,

(2) a vertically held tool which is applied to some soft, plastic material with a two-way sawing motion and downward-penetrating vector, as in the cutting of gritty meat.

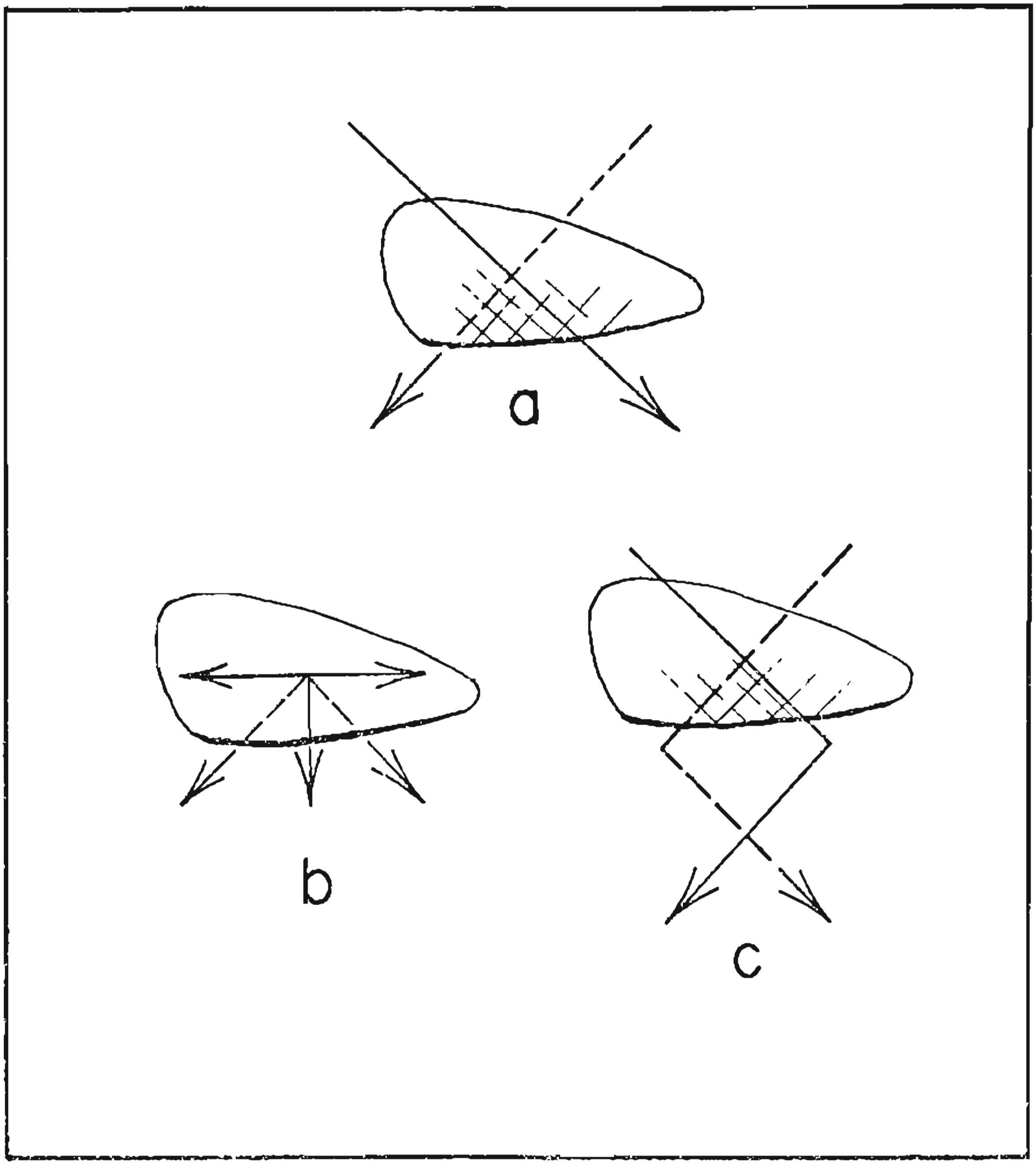

Fig. 8. Two varieties of motor activity required to produce oblique carving striae on a biface-blade tool surface. a, possible directions of tool travel for wood carving (whittling); b, vectors of force necessary for the carving of meat; c, directions of tool travel associated with the carving of meat.

Sawing

Sawing activities are characterized by tools with the lowest mean working edge value in the sample (47°) and high frequencies of ignimbrite and chert implements. Most of the ignimbrite tools, however, are actually projectile points used as knives or saws, whereas the harder and more durable tools are mostly of chert. Soft scraping, carving, and hafting wear, in nearly equal amounts, are the major types of wear associated with these sawing tools. The latter is due largely to the presence of hafted projectile points used as sawing implements.

The principal tool action reconstructed for this function is a simple two-way motion with only slight (1-5mm) penetration of the wood or bone material being worked. The wear elements are thus limited to a very narrow margin on the working edge and do not generally extend over much of the blade or flake surface.

Chopping and Adzing

Chopping and adzing functions are accomplished largely with chert and ignimbrite tools (80%) which have working edge angles between 70°-80°. The three basic tool shapes are thick plano-convex forms ("domed scrapers") worked around most of their circumference, thin unifacially re-touched flakes, and bifacial blades. A fourth type, projectile points, is excluded from this discussion because of possible confusion between percussion and projectile-impact wear features. There is no dramatic co-occurring wear with these activities, although soft scraping, sawing, carving, hafting and edge grinding features are all present in minor amounts.

Although chopping and adzing tasks are very similar and the resultant wear patterns appear to overlap, there are certain morphological and functional features distinct to each action. Adzing involves a low-angle attack with a plano-convex tool form and results in smaller but more numerous dorsal hinge fractures. Chopping is apparently a more forceful downward directed activity with a somewhat heavier bifacial instrument, and produces more severe edge battering.

Projectile Impact

Projectile impact can be considered a functional activity in the sense that it is an indirect indicator of aboriginal subsistence behavior and hunting technology. Two types of impact wear are involved: heavy scratches (impact striae) on both sides of the blade caused by forceful contact with abrasive soil particles, and tip shattering (burin faceting) caused by striking bone or stone objects. Some investigators, however, consider such burin facets to be "intentional products of the burin technique, used either for the production of burins and burin spalls, or for modifying the shape of the point itself"(Epstein 1963: 187).

Sawing and hafting are the only compound wear patterns well represented, and each is present in about one-half of the impacted projectiles examined. The significance of finding cutting and projectile-impact features together is that this demonstrates these implements were used both as cutting tools (already conveniently hafted) and also as hunting projectiles, a duality never before demonstrated for archaeological specimens.

In order of their frequency, the following nine projectile point types exhibit impact features: Elko(n=16), Bitterroot(4), Pinto(3), Rose Spring(2), Humboldt concave base(2); and Black Rock concave base, Silver Lake, Lake Mohave, and Eastgate expanding stem, one each. In most cases it is only those specimens made of glassy materials which display impact features.

Drilling

Drilling functions are not well represented in the Hogup Cave assemblage as only one per cent (5 functional units) of the total functional complex involved drilling activities. In all of these examples chert was the only lithic material utilized, probably because of its wear-resistant qualities. The durability of this material, plus the possibility that only clean wood surfaces were worked, has probably resulted in the low apparent occurrence for this particular activity.

Faint christie striae and the presence of considerable crushed plant fiber along the blades of several of these tools indicate that they were applied to woody materials with a twisting motion. Hand polish and pitch residues on the basal portions suggests that drills from Hogup Cave were used both as hafted and hand-held implements.

For the most part, tools exhibiting drilling features are uniformly shaped with a classic "key" outline and have a long, narrow, bifacially flaked blade with a diamond or thick lenticular cross section.

Awling

Awling functions are represented by a single bullet-shaped implement of chert. Like the blade or penetrating portion of drilling tools, the body of this artifact is bifacially flaked and has a diamond-shaped cross section. The series of long striae which parallel the long axis are much like impact striae and may have been produced when the tool penetrated through the worked material (skin?) and into the ground beneath.

CHAPTER 6

NON-ATTRITION FEATURES

Certain macro- and microscopic surface phenomena present in the Hogup Cave sample, although not directly related to specific technological activities, are nonetheless important to this functional analysis as a whole. They include hand polishing, haft wear, mastic residues, sinew binding remains, complete handles, apex abrasion, deliberate edge preparations, and plant remains. Their identification and interpretation is important because many can be mistaken for authentic use-wear, and others may be indicative of previous tool conditions or activities.

Handling-Hafting Features

Fig. 9 illustrates the types and distribution of 156 handling and hafting features observed in the Hogup sample. Haft wear, the most prevalent of these, is commonly found as a series of faint longitudinal scratches on the basal or neck portion of obsidian or ignimbrite projectile points. These striae are probably produced during the hafting process by particles of sand trapped between the tool surfaces and the notch of the wooden shaft.

The second most common type of evidence is the tool polish imparted to convex, and some concave, tool surfaces

HANDLING/HAFTING FEATURES / TOOL TYPE	A SINEW REMAINS	B PITCH	C HAFT WEAR	D HAND POLISH	A+B+C: TOTAL HAFT EVIDENCE
UNIFACIALLY MODIFIED FLAKES	1	-	5	21	6
BIFACIALLY MODIFIED FLAKES	-	-	-	3	0
UNMODIFIED FLAKES	-	2	-	-	2
BIFACE BLADES	-	9	4	8	13
PLANO-CONVEX "DOMES"	-	-	4	-	4
PROJECTILE POINTS	8	6	74	-	88
"GIANT POINTS"	-	1	4	-	5
DRILLS	-	2	-	4	2
TOTALS	9	20	91	36	120

Fig. 9. The distribution of handling and hafting features on Hogup Cave chipped stone tools.

by prolonged hand friction and the presence of fine particles of grit on the operator's hands. Biface blades and unifacially modified tool forms such as hand-held end-scrapers are the types most often associated with this particular use-phenomenon.

Plant resin mixed with animal hair was apparently employed as a hafting mastic for a variety of tools, principally bifacial blades and projectile points, most of which are associated with cutting activities. Even though such resin was noted on nearly every portion of these tools, the residues were mainly restricted to the basal or distal section where a wooden or bone handle would most likely have been attached. In several examples the remains were especially dramatic and clearly retained the original outline or cast impression of the missing handle element. One unusual specimen --a long, blade-like, unmodified flake saw-- appears to have once been embedded sideways into a mass of resin, either with a simple lump of this material as a handhold (similar to Australian spinifex resin-embedded flake tools) or with a longitudinally slotted branch for a handle.

The only available specimen with a complete handle is a unifacial, hard scraping tool bound to a short section of animal rib with a leather thong. It is not known, however, what haft wear was produced by this bone-stone contact since it was not possible to completely remove and inspect the stone scraper element.

Overall, projectile points from the Hogup Cave sample exhibited the greatest number of hafting features.

Tool Backing Techniques

Purposeful edge dulling or tool backing can be observed in a total of 41 specimens (excluding projectile points), and is almost entirely restricted to tools with sawing functions. The techniques used to blunt otherwise sharp and uncomfortable edges are:

(1) grinding(18)

(2) steep unifacial retouch(10)

(3) cortex retention or intentionally unflaked margins(7)

(4) burin or snapped edges(6)

In every case these features are located on the margin opposite the working(sawing) edge and could easily have afforded a practical and comfortable seating platform for the operator's index finger. The implements so modified have a mean working edge value of 54° as compared with 79° for the backed/dulled edge portions of the same tools.

Edge Grinding-Dulling

Unless some sort of stone-working function is proposed, it must be assumed that a grinding type of edge modification was deliberately produced to facilitate the trimming of bifacial blanks (Sheets 1973) or, as discussed above, for the backing of hand-held sawing implements. The co-occurring microwear evidence associated with such grinding efforts are illustrative of this point: of a total of 63 edge-ground artifacts, 97 per cent are either unutilized or exhibit only cutting wear. In strictly morphological terms, 57 per cent of these tools are bifacial blades and 22 per cent are flakes which retain portions of an edge-ground striking platform. Furthermore, 64 per cent of the prepared bifacial blades are void of any use-wear, which indicates that they are not bonafide "tools" but rather blanks or preforms in the process of manufacture (cf. Muto 1971). The 14 flakes recovered with remnants of a ground striking platform are probably examples of the type of thinning debris produced from such prepared artifact margins.

Because heavy christie striae frequently result from this type of edge grinding process, care must be taken not to confuse these features with similar use-wear elements relating to hide-scraping functions.

Surface-apex Abrasion

Apex abrasion is a generalized scuffing or light crushing of tool surface convexities. Because of its peculiar nature, the abrasive agent involved must have been stone, either in the form of a flat, solid surface or else as particles supported on some other hard surface such as wood. There appear to be only two activities capable of providing such contact situations: accidental storage wear due to contact with neighboring artifacts, or the original flaking process wherein trimming waste was crushed between the tool surface and a supporting anvil base.

Plant Debris

The examination of flake scar crevices revealed numerous small fibers and occasional pickleweed seeds on 64 artifacts. Glycerine slides were made of most of these and under higher magnification showed that the fibers were plant cellulose rather than animal protein. Although it was not attempted in the present study, the presence of identifiable opal phytoliths in many of these fibers could, in the future, lead to more precise functional interpretations of certain plant processing implements. Unidentified organic residues have also been reportedly observed on biface-blade knives from Nevada dry cave sites (Hester 1970).

Bifacial blades and unifacially modified flakes are the tool types most commonly contaminated with plant fiber; cutting and soft scraping are the principal functional activities (Table I). However, this does not give a completely accurate picture of the actual tasks involved because the unifacially modified flake types and concomitant soft scraping microwear are from those tools used both as hide end-scrapers and wood saws. Perhaps the real significance of plant fiber contamination is that sawing, drilling, adzing, chopping and

TABLE I

DISTRIBUTION AND ASSOCIATION OF PLANT DEBRIS

Total Number of Artifacts Involved- 64

Projectile Points- 7
Unifacially modified flakes- 17
Bifacially modified flakes- 3
Unmodified flakes- 3
Bifacial blades- 20
Plano-convex "domes"- 7
Drills- 4
Giant points- 3

Associated Tool Functions- 66

Soft scraping- 18
Cutting- 36
Hard scraping- 5
Percussion- 7

On Tools Without Diagnostic Wear- 11

hard scraping tools all show such direct evidence of plant contact, and that plant processing does not always produce observable microwear on chipped stone tool surfaces.

CHAPTER 7

FUNCTIONAL TOOL TYPES

Up to this point in the examination and discussion of the Hogup Cave functional complex, little mention has been made of specific functional tool types. Rather, the emphasis has been on artifact morphology and manufacture, microwear elements, and individual functional activities. The attempt now is to add a functional dimension to the traditional morphological view of artifact classification by establishing and defining categories for as many of the 1,000 chipped stone tools as possible.

On the basis of similar function and manufacture, more than 74 per cent of the assemblage can be organized into the 13 functional tool types presented in Table II. The remaining 252 artifacts are either unutilized or are not functionally or stylistically diagnostic. For lack of a better method, projectile point and drill categories are organized principally on the basis of morphological similarities because functionally identified specimens constitute only a small portion of these groups. In all other cases, however, the sharing of functional traits is the main basis for classification, and the shape or manufacture of the tool is less important.

TABLE II

FUNCTIONAL TOOL TYPES FROM HOGUP CAVE*

Simple Projectile Points (only 39 with classic use-wear)	281
Projectile Saw/Knives	119
Flake Saw/Knives	80
Flake Hide-scrapers	71
Biface-blade Saw/Knives	62
Hide-scraper/Saws	35
Biface Blanks	23
Adzes	19
Drills (only 3 with classic use-wear)	17
Simple Hard Scrapers	16
Hogup Saws ("Giant Points")	7
Choppers	6
Awl/Perforators	1
Miscellaneous	11
TOTAL CLASSIFIED TOOLS	748
UNUTILIZED OR UNCLASSIFIED TOOLS	252

------

*Revised from Wylie 1973:8 (Table I). All categories mutually exclusive; sample size: 1,000.

Definition of Functional Tool Types

In general, the following functional tool types are provided to give some indication of the range of functional activities possible with certain tool forms. Although casual comparisons are no substitute for a complete local program of microscopic inspection and experimental replication, this section may also serve as a guide to others in the interpretation of similar tool kits elsewhere. The outline form of presentation was adopted to facilitate reference and reduce the length of the tabulation.

Simple Projectile Points

No. of specimens: 281 total, 39 with the type of diagnostic wear features listed below.

Illustrative examples: Fig. 10a,b,c

Morphological features:

Triangular to lanceolate in form

Fine percussion flaking common; pressure flaking rare

Thin lenticular cross section

Stemmed or notched bases common

Wear characteristics:

Impact striae

Burin scars on tip

Hafting striae or plant resin residues on base

Interpreted use: From the 14 per cent of the projectile points which exhibited these wear characteristics, it is

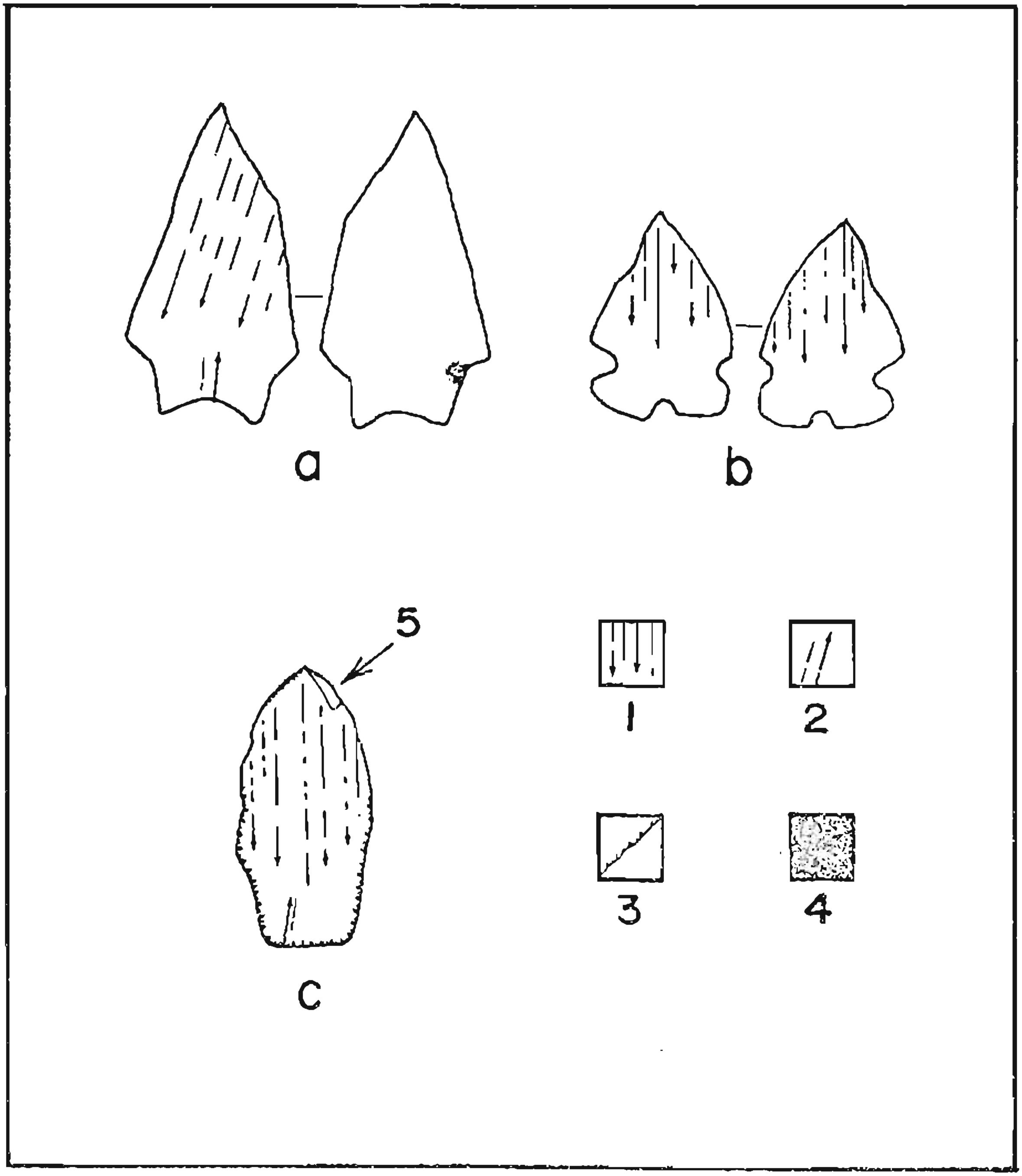

Fig. 10. Simple Projectile Points from Hogup Cave. a, Pinto sloping shoulder (ignimbrite); b, Elko eared (obsidian); c, Lake Mohave (obsidian). 1, impact striae; 2, hafting striae; 3, battered edge; 4, resin; 5, burin impact scar. All specimens actual size.

concluded that these artifacts were hafted basally and sometimes subjected to deep penetration of loose soil or forceful contact with hard substances such as bone or stone.

Comments: The subtle scratches produced by impact or hafting are visible only on obsidian and ignimbrite specimens.

Projectile Saw/Knives

No. of specimens: 119

Illustrative examples: Fig. 11a,b,c

Morphological features: (same as Simple Projectile Points except generally restricted to the larger forms)

Wear characteristics:

Sawing (edge-parallel) and carving (oblique) striae

Edge polish, especially on the flake scar ridges adjacent to the working edge

Concoidal, edge-attrition flake scars

Hafting striae and pitch residues on both sides of the base or neck

Impact striae

Interpreted use: Hunting projectiles also used to saw and carve wood, bone and meat materials.

Comments: These artifacts were probably produced and hafted for use as hunting projectiles the same as Simple Projectile Points, the only difference being that during their lifetime they happed to be utilized as cutting implements. Sawing striae have also been identified on "Stockton Points" from central California (Nance 1971; Hester and Heizer 1973).

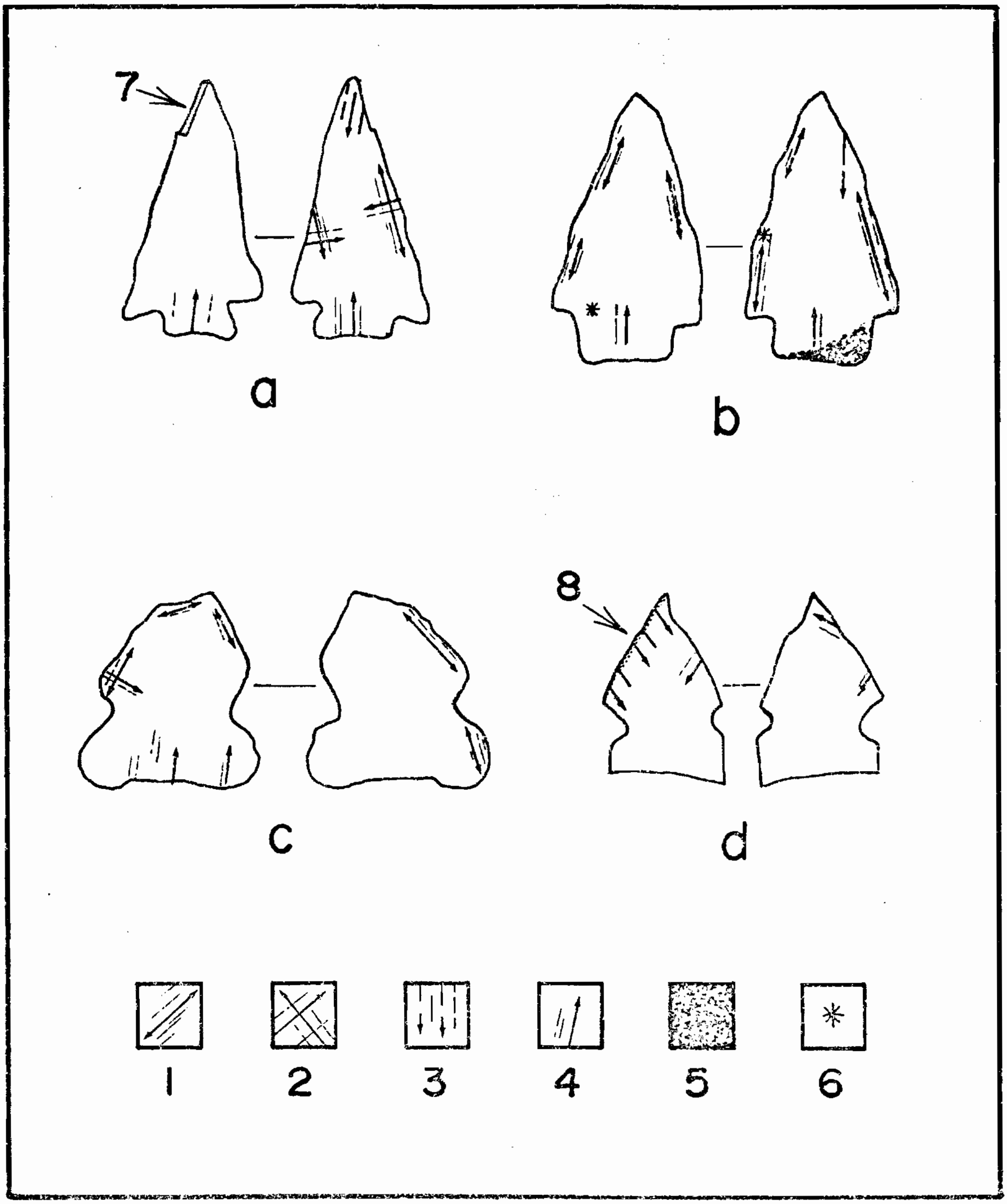

Fig. 11. Projectile Saw/Knives from Hogup Cave. a, Elko corner-notched saw and knife (obsidian); b, Elko corner-notched saw (ignimbrite); c, Elko side-notched saw and knife (obsidian); d, Elko side-notched knife (obsidian). 1, sawing striae; 2, carving striae; 3, impact striae; 4, hafting striae; 5, resin; 6, plant fiber; 7, burin impact scar; 8, abraded edge. All specimens actual size.

Flake Saw/Knives

No. of specimens: 80

Illustrative examples: Fig. 12a,b,c

Morphological features:

Unmodified, or with unifacial or bifacial edge modification

Occasional tool backing on margin opposite cutting edge

Wear characteristics:

Edge-parallel striae

Oblique striae (less common)

Sawing edge-polish

Concoidal, edge-attrition flake scars

Hand polish (rare)

Hafting wear

Interpreted use: These would appear to be hand-held or occasionally hafted implements for the sawing and carving of wood, bone, and perhaps meat. With the backed specimens, the operator's index finger was probably pressed against the superior tool edge to increase the downward cutting pressure.

Comments: By casual inspection with the naked eye it is easy to mistake a backed tool margin for the cutting edge, especially when the actual use edge is unmodified.

Flake Hide-scrapers

No. of specimens: 71

Illustrative examples: Fig. 13a,b,c

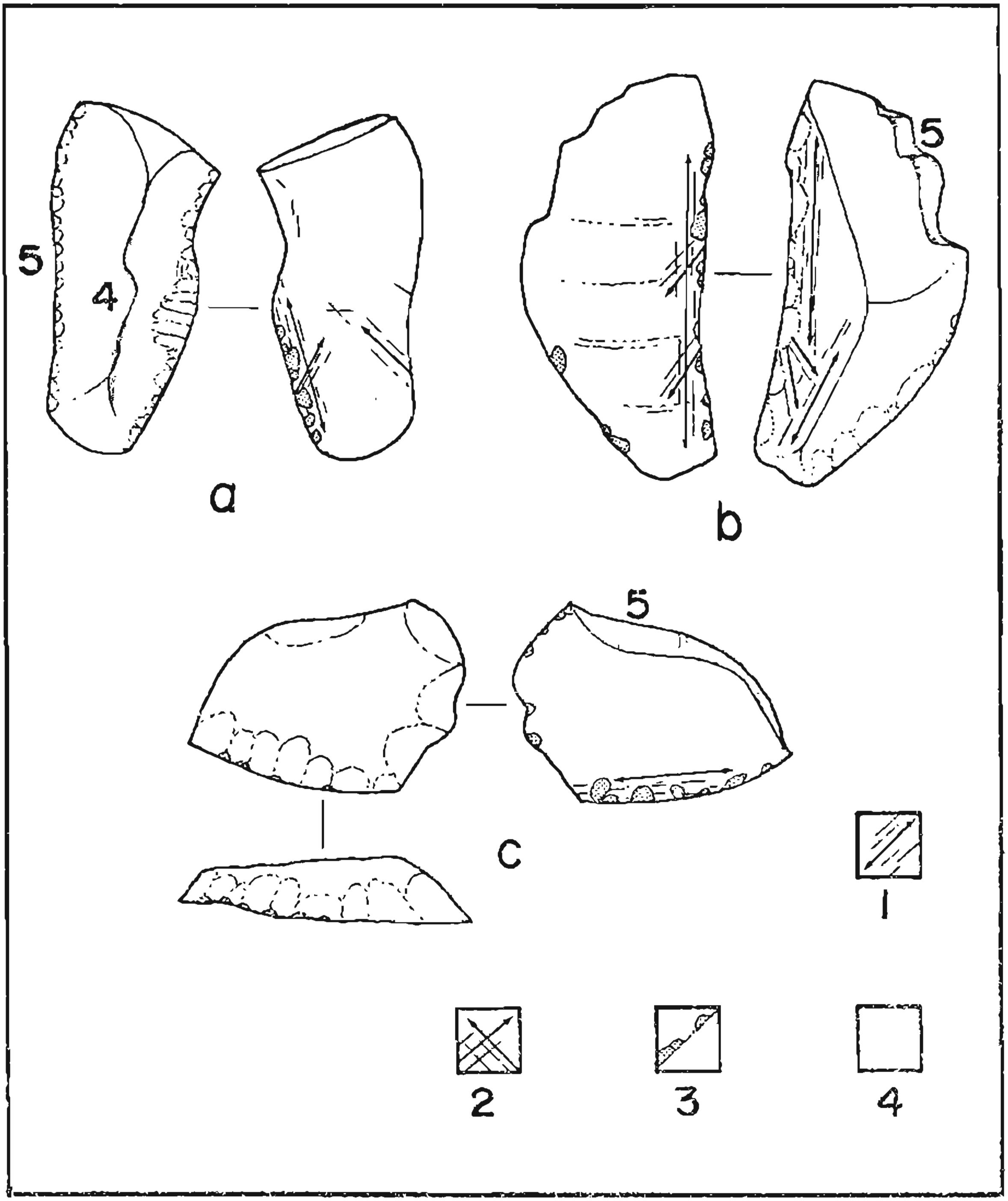

Fig. 12. Flake Saw/Knives from Hogup Cave. a, ignimbrite blade backed by nibbling retouch; b and c, obsidian and ignimbrite flakes backed by burin or snap techniques. 1, sawing striae; 2, carving striae; 3, sawing attrition flake scars; 4, hand polish; 5, backed edge. All specimens actual size.

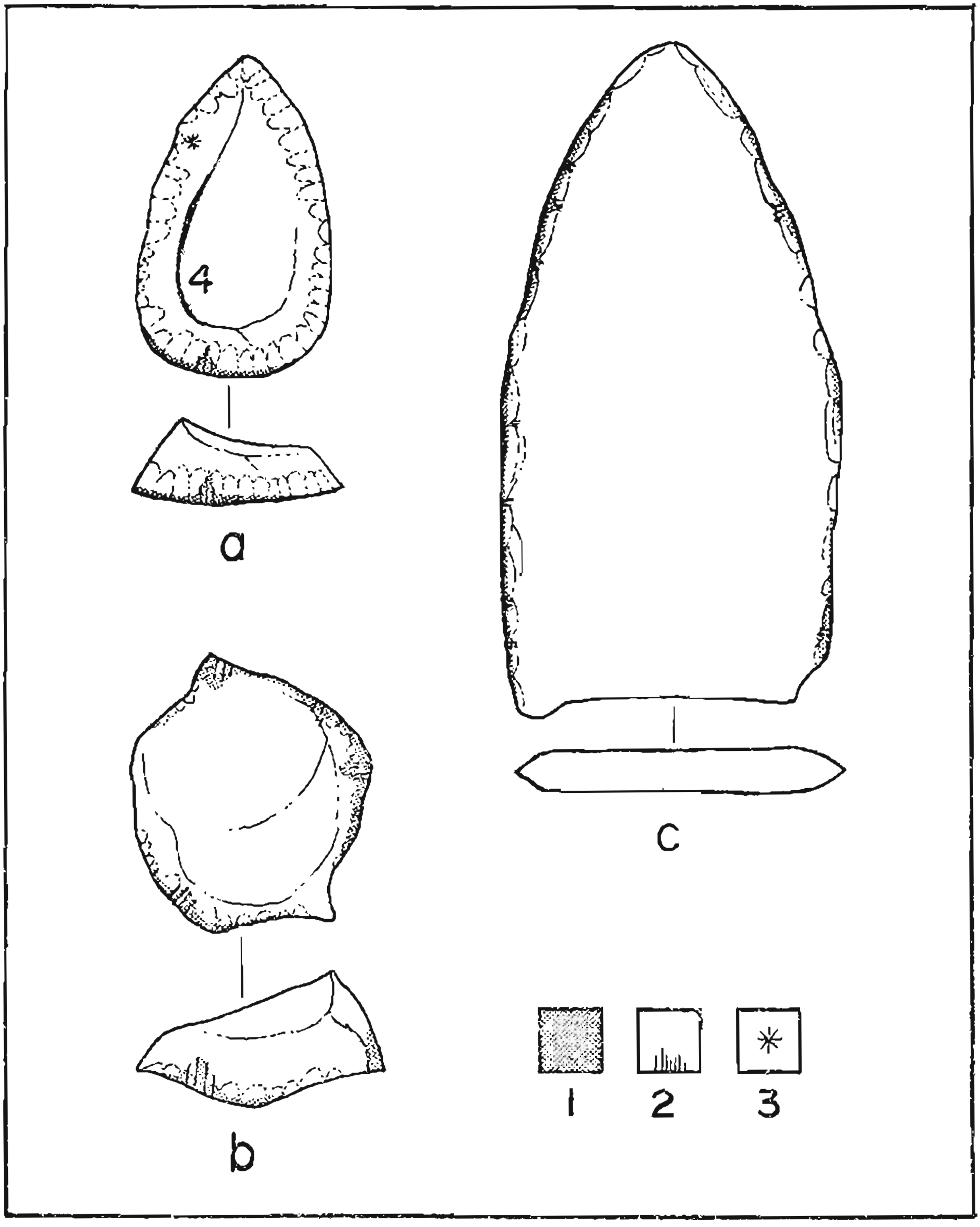

Fig. 13. Flake Hide-scrapers from Hogup Cave. a, end-scraper (chert); b, multi-edged scraper (chert); c, bifacially flaked multi-edged scraper (metamorphic). 1, hide scraping edge abrasion and polish; 2, christie striae; 3, plant fiber; 4, hand polish. All specimens actual size.

Morphological features:

Unifacial, percussion flaked scraping arc on the end or side of an otherwise unmodified flake

Multiple or extended scraping margins (rare)

Bifacially-modified scraping margins (very rare)

Wear characteristics:

Christie edge striae, abrasion and polish frequently extending far up the dorsal lip

Little or no ventral surface use-wear except for occasional hafting striae

Hand polish on the convexities of the dorsal surface

Interpreted use: Hand-held (or rarely hafted) near the vertical plane with the ventral flake surface facing the direction of travel, these tools were pressed into the worked skin surface and drawn toward the operator in a one-way scraping motion.

Comments: The aboriginal practice of resharpening dulled hide-scraper tool edges was very common and resulted in the removal of much of the characteristic scraping microwear.

Biface-blade Saw/Knives

No. of specimens: 62

Illustrative examples: Fig. 14a,b,c

Morphological features:

Generally asymmetrical in form

Sub-triangular to leaf-shaped outlines

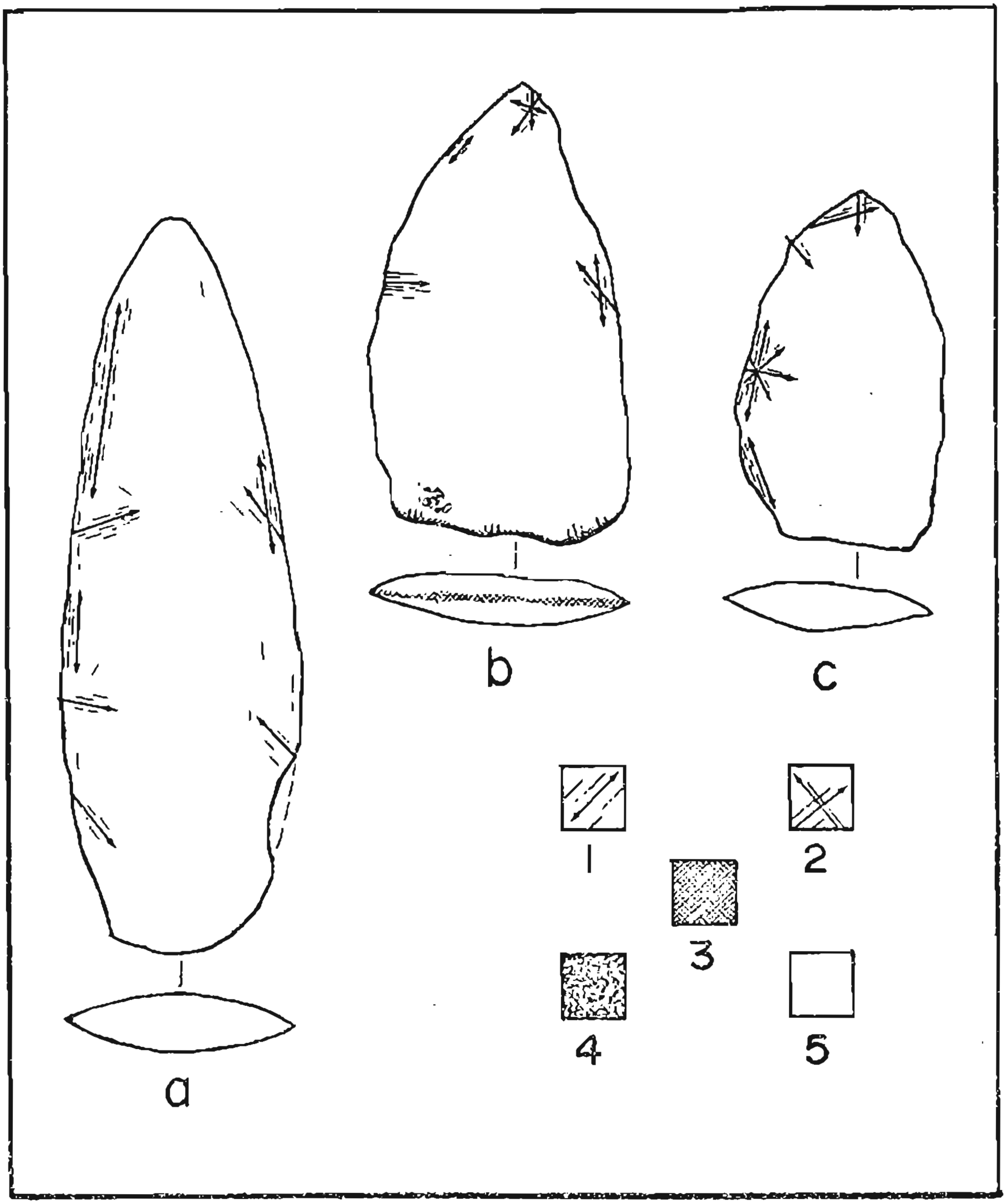

Fig. 14. Biface-blade Saw/Knives from Hogup Cave. a, symmetrical blade (ignimbrite); b, basally-ground asymmetrical blade (ignimbrite); c, asymmetrical blade (ignimbrite). 1, sawing striae; 2, carving striae; 3, ground edge with christie striae; 4, resin; 5, apex abrasion. All specimens actual size.

Thin lenticular cross sections

Complete bifacial flaking of both sides by percussion

Little or no fine pressure flaking retouch of edges

Wear characteristics:

Edge-parallel striae

Oblique striae

Sawing edge polish

Hafting wear and pitch residues

Hand polish

Interpreted use: Biface-blade Saw/Knives were used both as hand-held and hafted sawing and carving implements, with possibly a slightly greater inclination for sawing functions.

Comments: These implements show less edge attrition from cutting activities than do flake tools of similar function, possibly due to the stronger nature of their edges. There is also less handling polish and more evidence of hafting than with Flake Saw/Knives, but they are otherwise similar in the extent of sawing striae, carving striae and sawing edge polish present.

Hide-scraper/Saws

No. of specimens: 35

Illustrative examples: Fig. 15a,b,c

Morphological features: This type is characterized by a unifacial, percussion-flaked scraping arc on the end of a long flake, and the longer lateral edge(s) may or may not

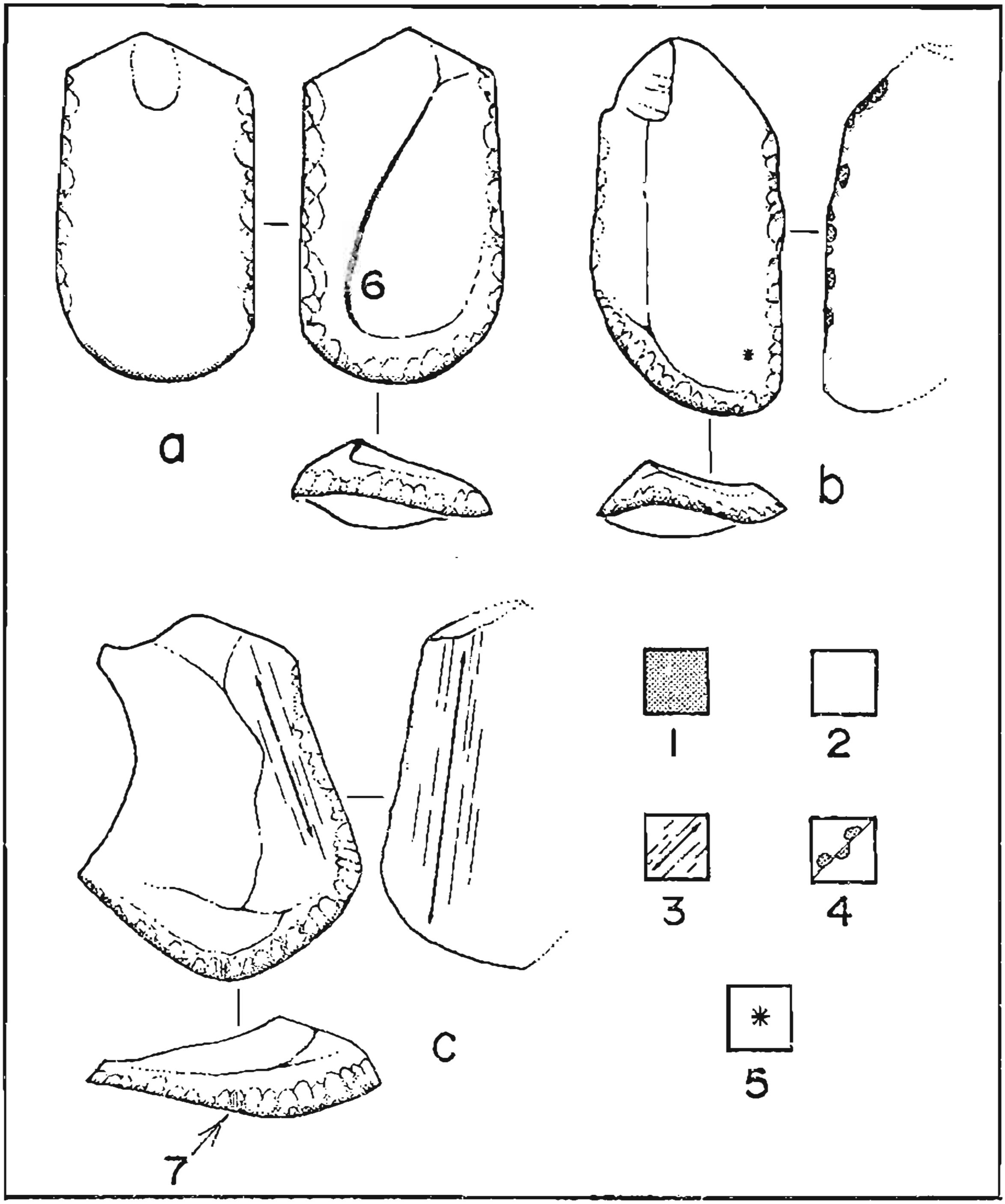

Fig. 15. Hide-scraper/Saws from Hogup Cave. a; end-scraper with two bifacially modified lateral sawing edges (chert); b and c, end-scrapers with unifacially modified sawing edges (chert). 1, hide scraping edge abrasion, 2, sawing edge polish; 3, sawing striae; 4, sawing attrition flake scars; 5, plant fiber; 6, hand polish; 7, hide scraping christie striae. All specimens actual size.

be modified by light percussion.

Wear characteristics: The functional characteristics of this type consist of the following combination of hide-scraping and cutting features:

Christie edge striae, abrasion and polish on the scraping edge and dorsal lip of the tool

Little or no ventral flake scraping wear

Edge-parallel striae

Sawing polish

Concoidal edge-attrition flake scars

Hand polish on the convexities of the dorsal surface

Interpreted use: Hide-scraping and sawing of wood or bone.

Comments: In physical appearance these tools are similar to Simple Flake Hide-scrapers except that the convex scraping edge is usually restricted to one end of the flake and one or more of the longer lateral edges are used for sawing. These sawing functions may or may not involve shaping or resharpening of the lateral edges. Heavy sawing wear on these edges might easily be erroneously attributed to tool-haft contact (cf. Wilmsen 1968:157). Authentic hafting wear is not found on these edges, but rather on the ventral (or rarely dorsal) surfaces. Moreover, there is much greater evidence of end-scrapers being hand-held during use than hafted to bone or wooden handles (see Fig. 9, page 43).

Biface Blanks

No. of specimens: 23

Illustrative examples: Fig. 16a,b,c

Morphological features:

Generally symmetrical in form

Sub-triangular to ovoid in outline

Crude percussion flaking

Ground-dull edges

Wear characteristics: None

Interpreted use: Because of their complete lack of use-wear, these artifacts are interpreted as tool forms in the process of manufacture.

Comments: In overall appearance these bifaces are morphologically similar to the Biface-blade Saw/Knives, but can be easily differentiated by their more ovoid and symmetrical outlines, cruder flaking and characteristic ground edge features. Edge grinding is probably a preparation for the final stages of flaking.

Adzes

No. of specimens: 19

Illustrative examples: Fig. 17a,b,c

Morphological features:

Manufactured on thick flakes

Unifacially flaked by percussion, with some specimens worked around entire margin

Plano-convex "dome-like" profile typical

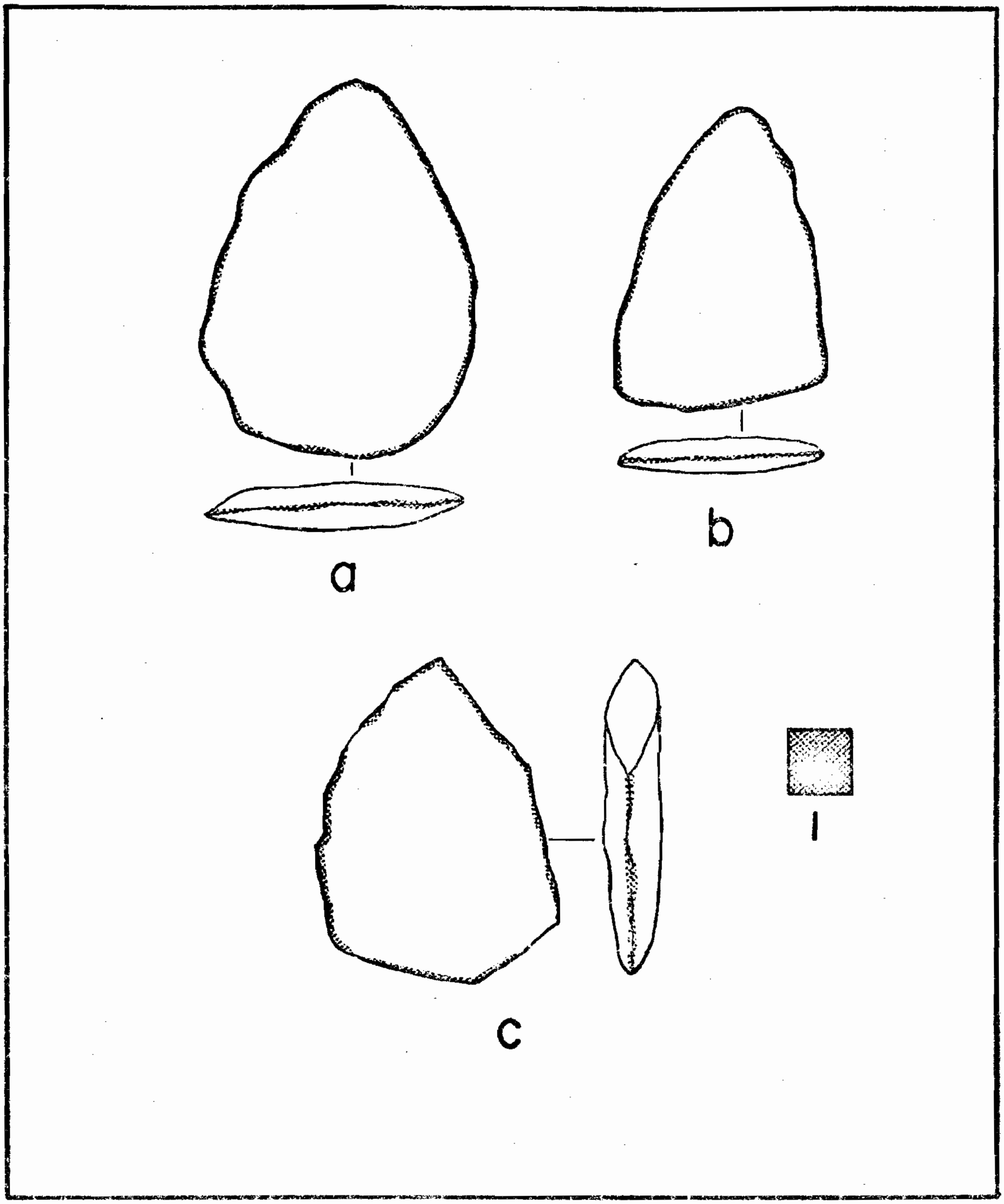

Fig. 16. Biface Blanks from Hogup Cave. a, ignimbrite; b, obsidian; c, ignimbrite blank with partially unflaked margin. l, ground edges. All specimens actual size.

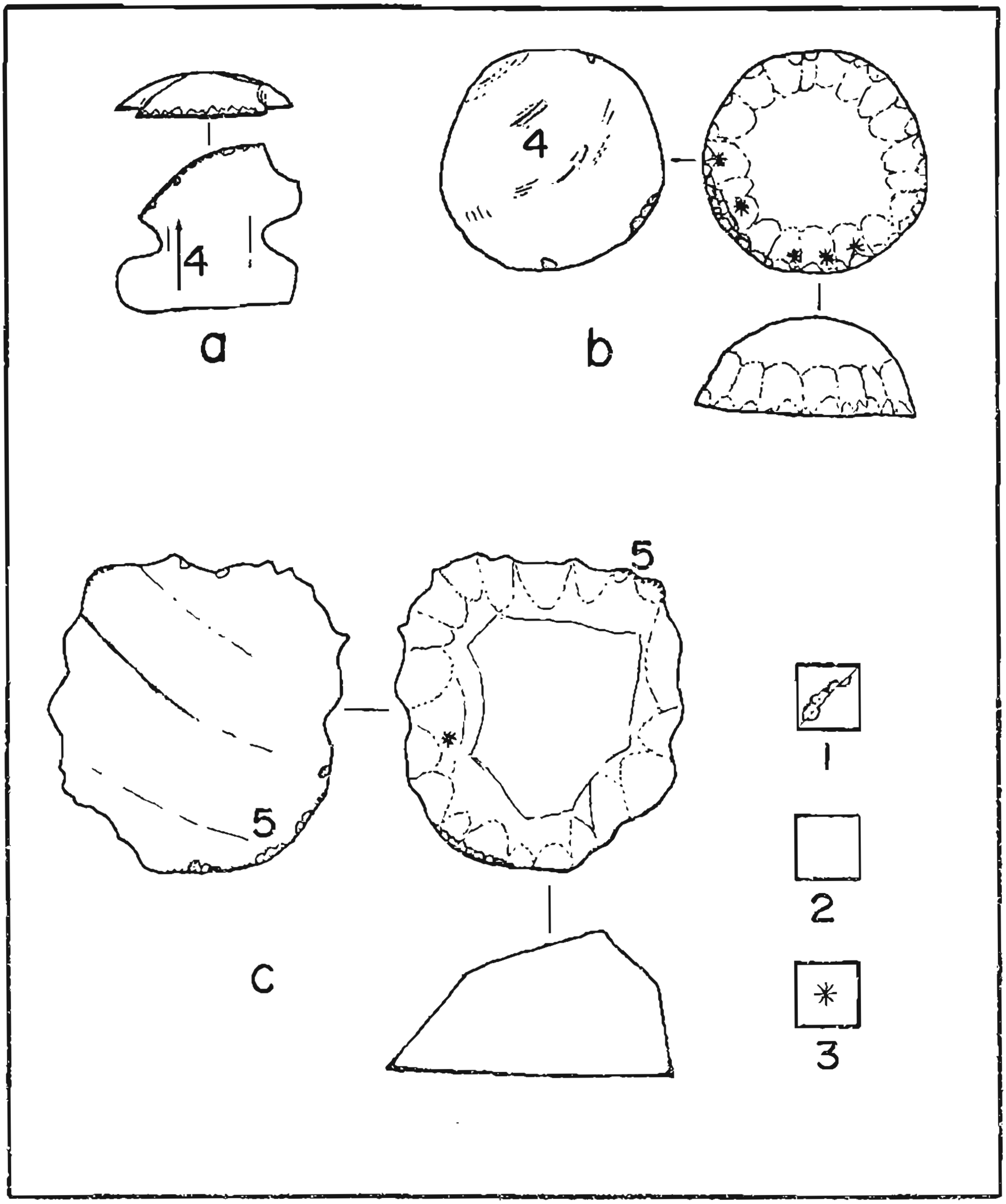

Fig. 17. Adzes from Hogup Cave. a, obsidian projectile point fragment; b and c, chert plano-convex forms. 1, step-fracture flake scars; 2, surface polish; 3, plant fiber; 4, hafting striae; 5, battered edge. All specimens actual size.

Wear characteristics:

Heavy and numerous hinge fracture flake scars on the dorsal lip of the bit (working) end

Ventral lip hinge fracture flake scars slightly less common

Ventral lip and surface polish and scuffing

Ventral lip and surface striae, abrasion and use-bevel features (rare)

Slightly battered and dull poll end (rare)

Super lustre on ventral lip (rare)

Ventral surface hafting striae

Interpreted use: These implements were hafted or hand-held with the convex-dorsal surface up, and used at a low working angle for the percussion shaping of semi-clean wood surfaces.

Comments: The above discussion and description excludes 6 broken projectile points which may have been used as adzes.

The extensive hinge fractures on the dorsal lip of most of these adzes may be the result of resharpening or cleaning of crushed wood fibers which clog the working edge (cf. Crabtree and Davis 1968:428) rather than ordinary use-wear.

The occasional ventral lip abrasive features are caused either by accidental contact with soil or a stone anvil, or else the presence of sand on the worked surface.

Drills

<u>No. of specimens</u>: 17 total, 3 with diagnostic wear

<u>Illustrative examples</u>: Fig. 18a,b,c

<u>Blade morphological features</u>:

Narrow lanceolate with generally parallel margins

Pointed tip

Thick diamond-shaped cross section

<u>Base morphological features</u>:

Wider than blade

Thinner and more lenticular in cross section

Less completely flaked

<u>Wear characteristics</u>:

Christie striae on blade

Edge polish on blade

Plant fiber on blade

Hand polish on base

Plant resin residues on base

<u>Interpreted use</u>: These implements were hafted and hand-held (the latter being slightly more common) and were used with a twisting motion to penetrate clean, non-gritty wood surfaces.

Simple Hard Scrapers

<u>No. of specimens</u>: 16

<u>Illustrative examples</u>: Fig. 19a,b,c

<u>Morphological features</u>:

Burinated or snapped flake edges or steep, unifacially

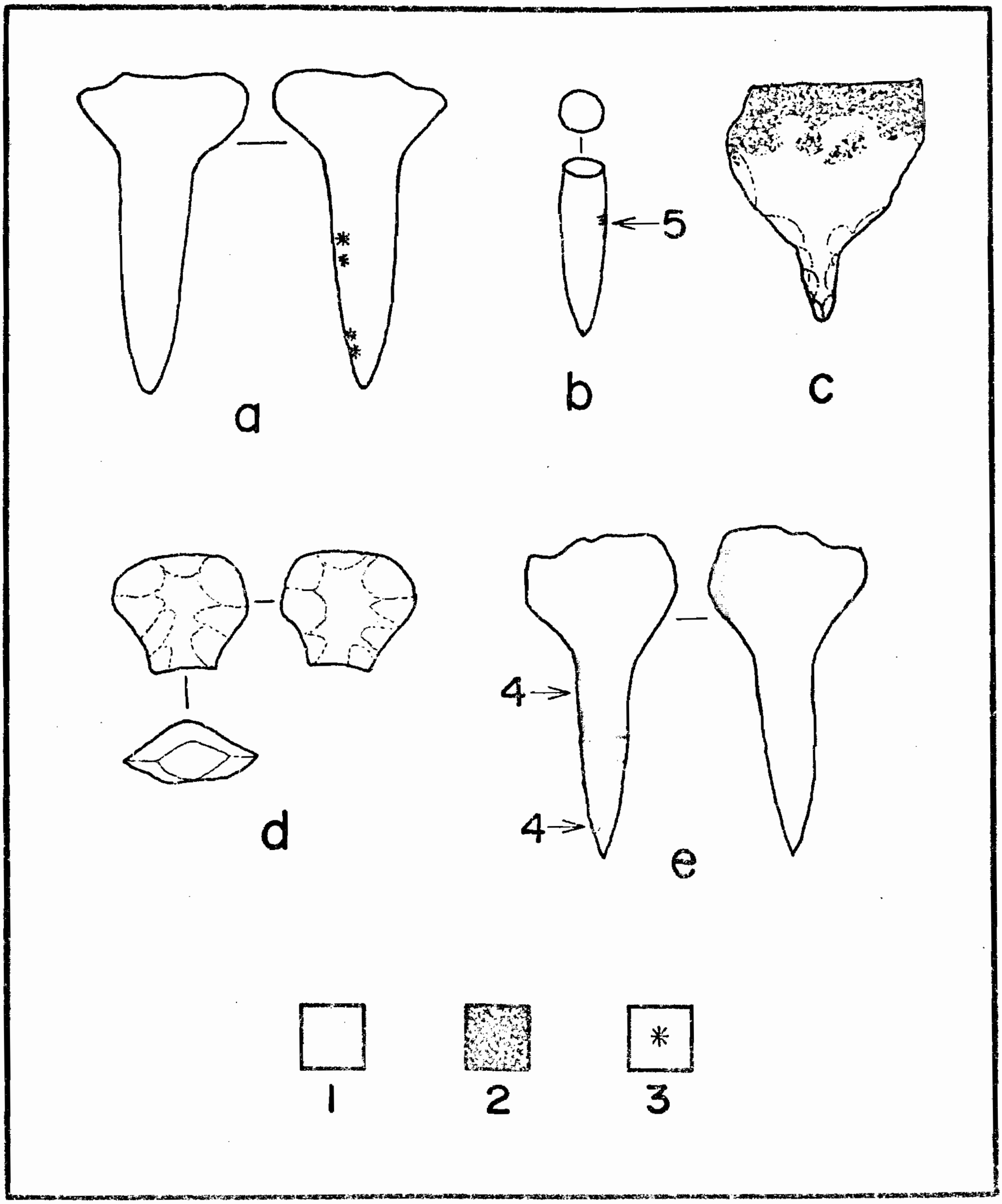

Fig. 18. Drills from Hogup Cave. a, chert drill with plant fiber; b, chert drill tip with edge wear; c, chert drill with resin; d, chalcedony drill butt with handling wear; e, chert drill with handling polish and edge wear. 1, hand polish; 2, resin; 3, plant fiber; 4, edge drilling polish and abrasion; 5, christie striae. All specimens actual size.

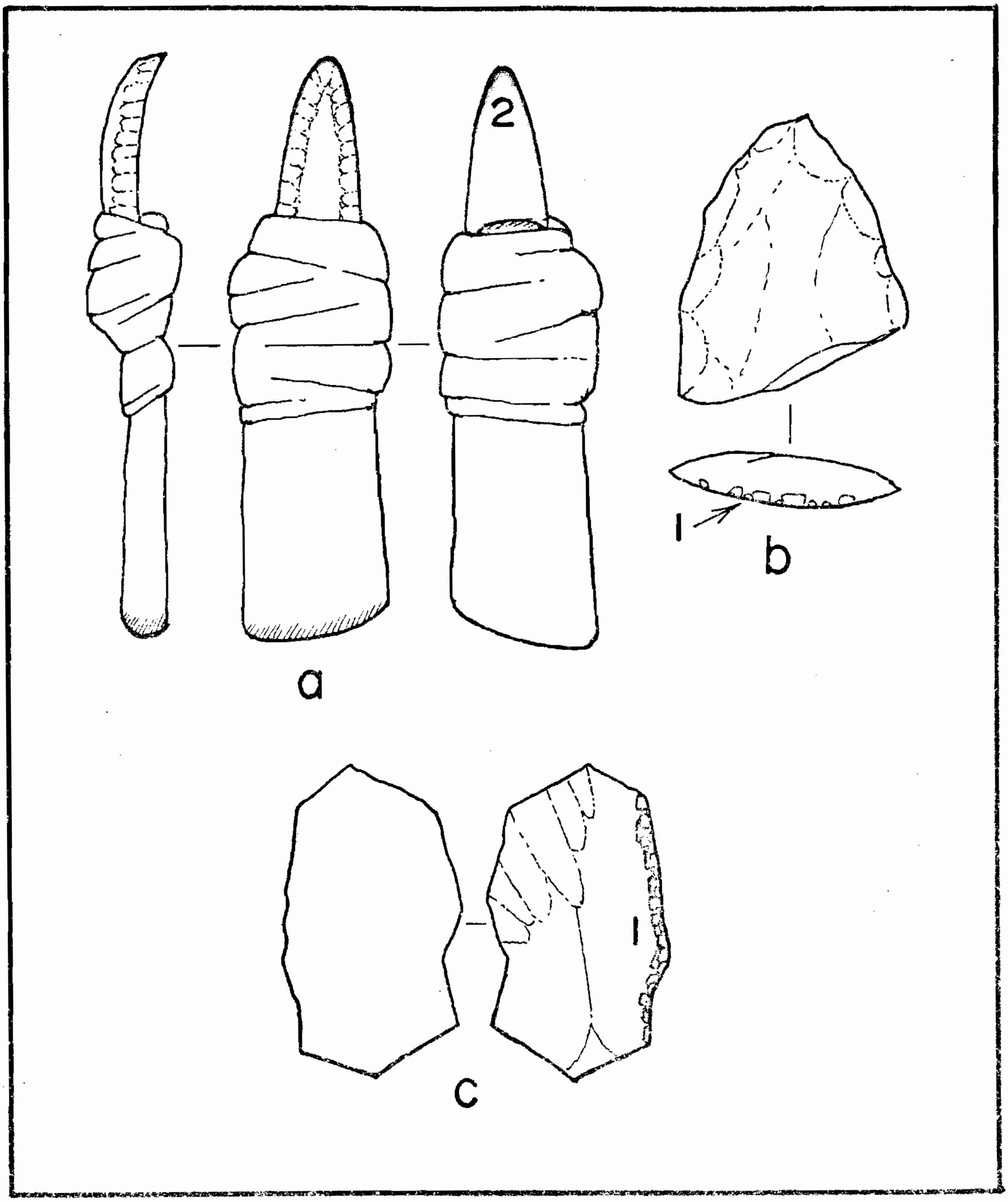

Fig. 19. Simple Hard Scrapers from Hogup Cave. a, chert scraper hafted on an animal rib and bound with leather strips; b, chalcedony biface-blade; c, ignimbrite flake. 1, step fracture flake scars; 2, hard scraping edge abrasion and polish. All specimens actual size.

flaked edges

Straight to slightly convex or concave working margins

Wear characteristics:

Small step-fractured flake scars along the dorsal lip of the working edge

Faint christie striae on the dorsal face (rare)

Super lustre on the dorsal lip (rare)

Plant debris

Interpreted use: These tools were held at a high working angle and applied to wood or bone surfaces with a one-way scraping motion toward the operator.

Comments: Sixteen additional "hard scraper" tools of a multifunctional nature are included under the discussions of various other functional tool types.

Hogup Saws- "Giant Projectile Points"

No. of specimens: 7

Illustrative examples: Fig. 20a,b,c

Morphological features:

Large, stemmed or notched lanceolates

Dull, rounded tips

Side- or corner-notched, or stemmed at the end opposite the point

Completely bifacially flaked by percussion

Relatively steep edge angles for sawing tools (mean 59°, range 55°-70°).

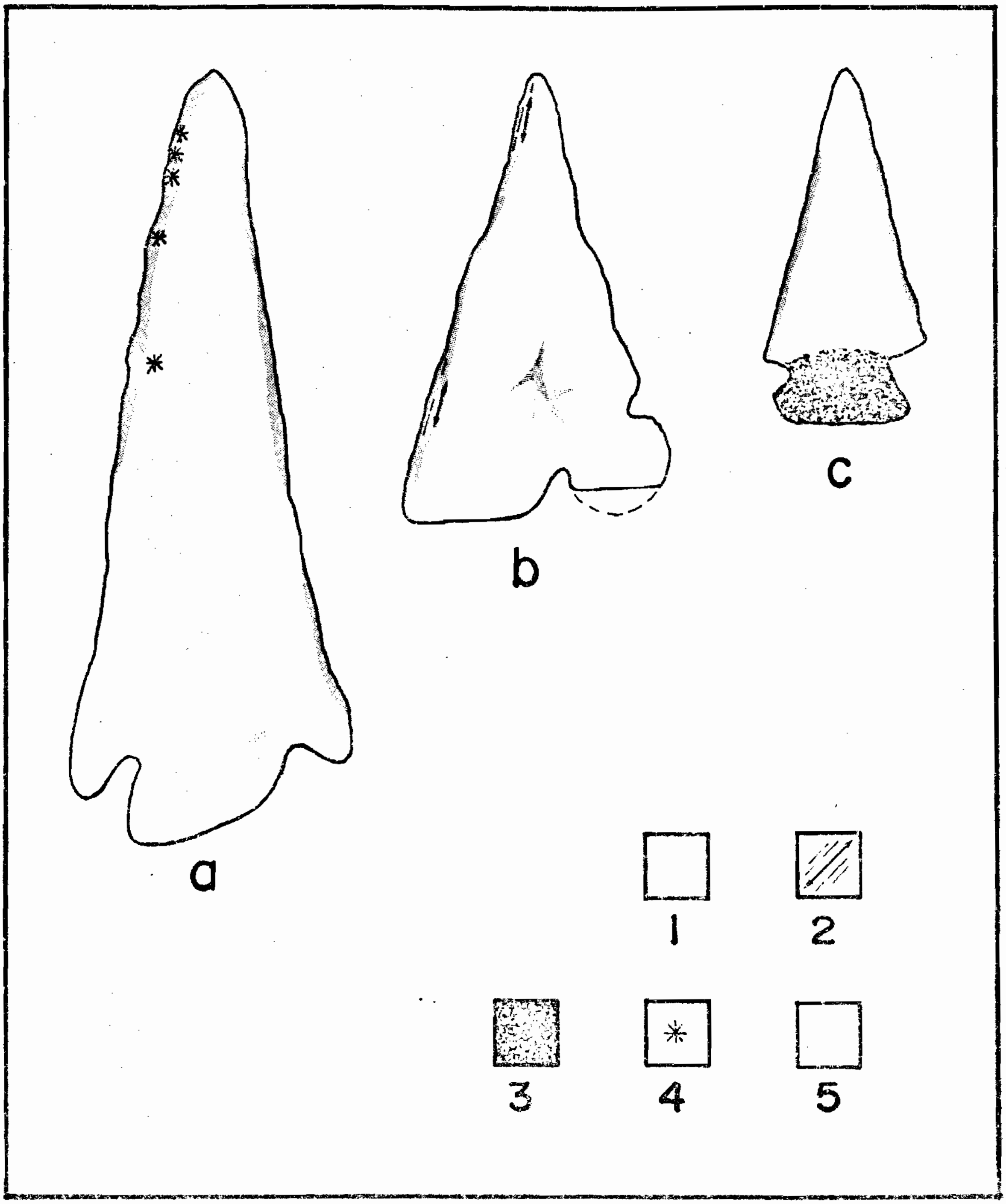

Fig. 20. Hogup Saws from Hogup Cave. a and c, chert; b, ignimbrite. 1, sawing polish; 2, sawing striae; 3, resin; 4, plant fiber; 5, haft or hand polish. All specimens actual size.

Wear characteristics:

Edge-parallel striae

Heavy sawing edge polish

Hafting striae and plant resin residues on both sides of the base or neck

Plant debris along both lateral edges

Interpreted use: Hogup saws were hafted and used with a two-way motion to saw wooden items.

Comments: These tools are well suited for heavy-duty sawing tasks. Their bifacial edges are steeper than the mean for most sawing functions; a wooden handle would have afforded more grasping power and leverage, and their large size (mean length= 87mm) more cutting edge and mass.

Choppers

No. of specimens: 6

Illustrative examples: Fig. 21a,b,c

Morphological features:

Manufactured on one side of a core or macroflake

Bifacially flaked by crude percussion, or else unifacially flaked by crude percussion and thus plano-convex in cross section

No fine retouch

Wear characteristics:

Severe bit edge battering and dulling

Step-fractured flake scars on the bit end

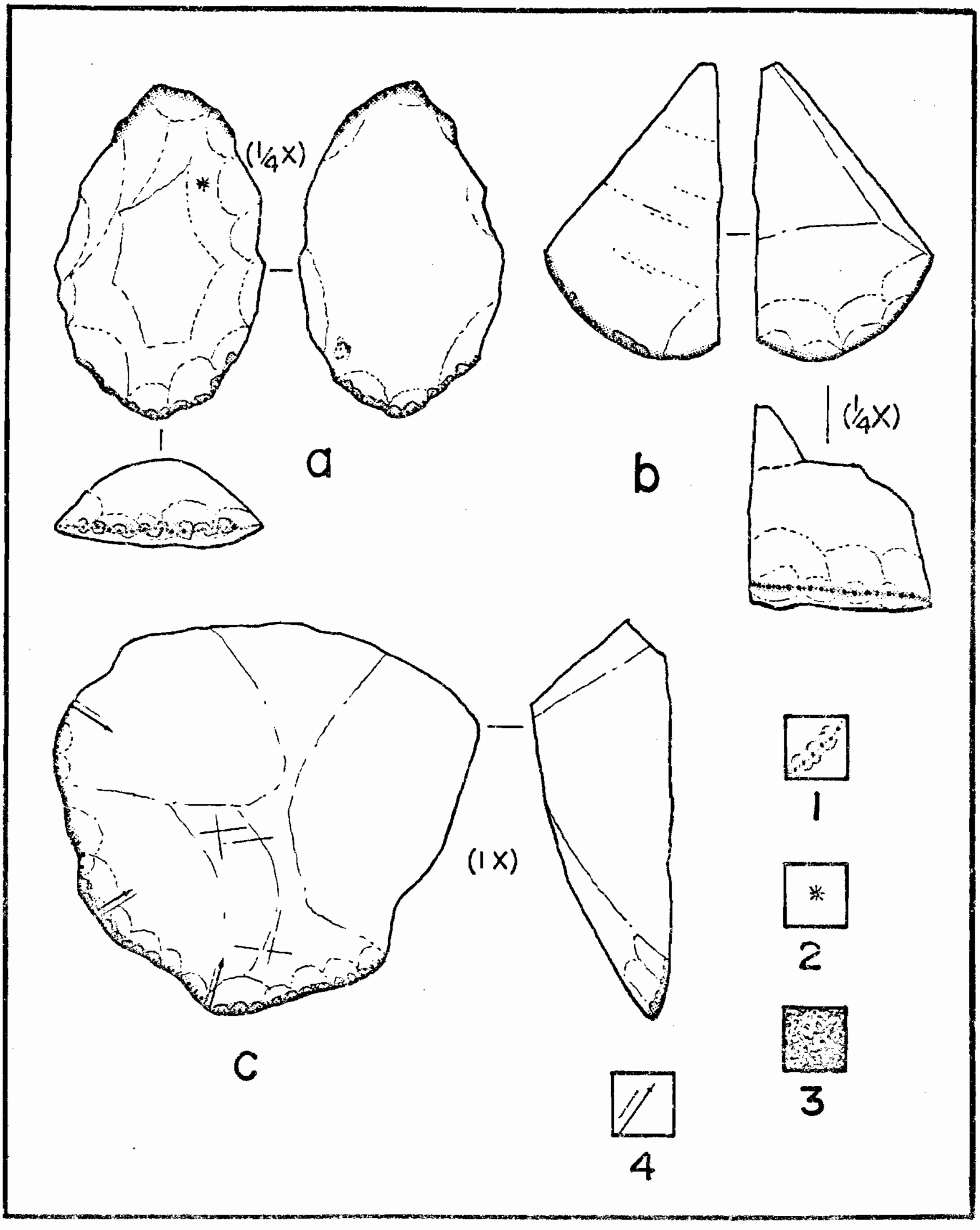

Fig. 21. Chopping tools from Hogup Cave. a and b, chert; c, ignimbrite. 1, battered edge and step-fracture flake scars; 2, plant fiber; 3, resin ; 4, impact striae.

Plant debris on the bit end

Interpreted use: Chopping tools were used with heavy percussion against hard, clean surfaces such as wood and bone.

Awl/Perforators

No. of specimens: 1

Illustrative example: Fig. 22c

Morphological features:

"Bullet-shaped"

Thick, diamond-shaped cross section

Narrow, lanceolate body

Sharply pointed at one end, blunt at the other

Fine bifacial pressure flaking over the entire surface

Wear characteristics:

Fine longitudinal striae

Interpreted use: This particular tool was used for the deep, non-twisting penetration of some soft and/or gritty material, possibly animal skin laid on the ground or otherwise contaminated with abrasive particles of sand.

Anomalous/Exceptional Specimens

Projectile Point/Hide-scraper

No. of specimens: 1

Illustrative example: Fig. 22b

Morphological features:

Basal section of a broken, side-notched projectile point

Unifacially flaked along the transverse break

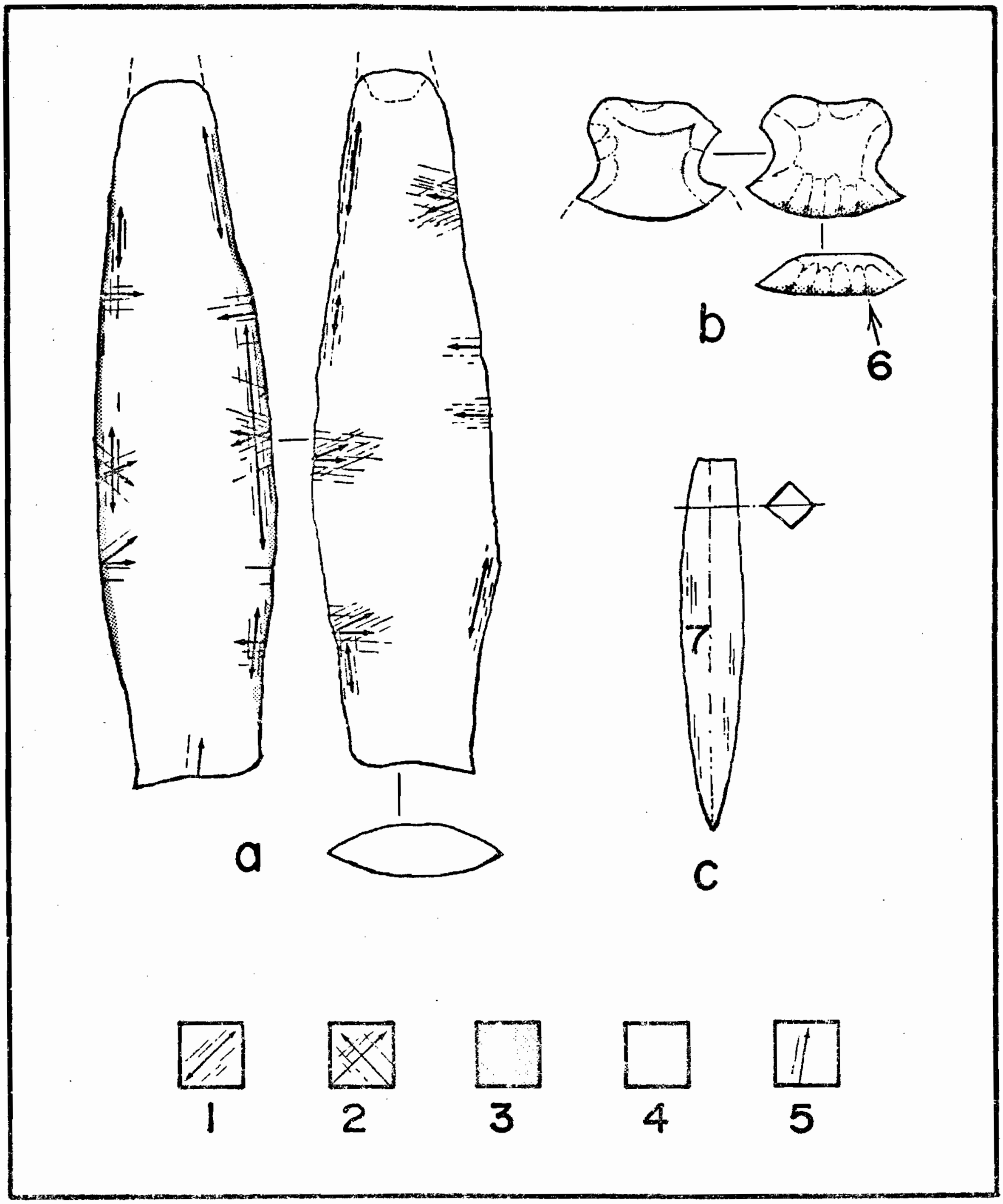

Fig. 22. Miscellaneous tools from Hogup Cave. a, striated lanceolate (ignimbrite); b, projectile point fragment hide scraper (chert); c, awl (chert). 1, sawing striae; 2, carving striae; 3, abraded edge; 4, haft polish; 5, hafting striae; 6, hide scraping edge abrasion and christie striae; 7, impact striae. All specimens actual size.

Wear characteristics:

Christie striae, edge polish and abrasion from hide scraping

Hafting polish from arrow shaft(?)

Possible sinew-binding polish in side notches

Interpreted use: This artifact, originally hafted and used as a projectile point, was accidentally broken during use and subsequently flaked and used as a hide scraper.

Striated Lanceolate

No. of specimens: 1

Illustrative example: Fig. 22a

Morphological features:

Lanceolate-shaped artifact with broken tip and blunt base

Bifacially flaked by percussion

Lenticular in cross section

Wear characteristics:

Heavy edge abrasion and extensive striae, most of which are perpendicular to the tool edge

Sawing (edge-parallel) striae are less common and not quite as severe

Asymmetrical edge wear

Plant debris

Interpreted use: This tool was used primarily for sideways scraping or cutting of some soft and heavily-sanded material (hide?). During this task it was probably grasped at both ends and drawn toward the operator at a very low working angle. It was also used with a two-way sawing motion for the cutting of clean wood surfaces.

Comments: This striated lanceolate was originally classified as a "Scottsbluff" projectile point.

Worn Uniface

No. of specimens: 1

Illustrative example: Fig. 23a

Morphological features:

Unifacially flaked working margin on distal end

Bifacially flaked proximal end

Rough trapezoidal cross section

Wear characteristics:

Short, severe and densely concentrated striae perpendicular to the edge

Edge polish on the flake compression ridges of the ventral surface

Edge attrition flake scars on the dorsal lip

Ventral surface hafting wear

Interpreted use: The precise function is uncertain. It was definitely used against a gritty surface which was both soft enough to remain in contact with gently rounded surfaces, yet hard enough to produce areas of intense surface polish.

Comments: These particular striae are unusual because they are very short and deep, and do not originate at the tool edge as is usually the case.

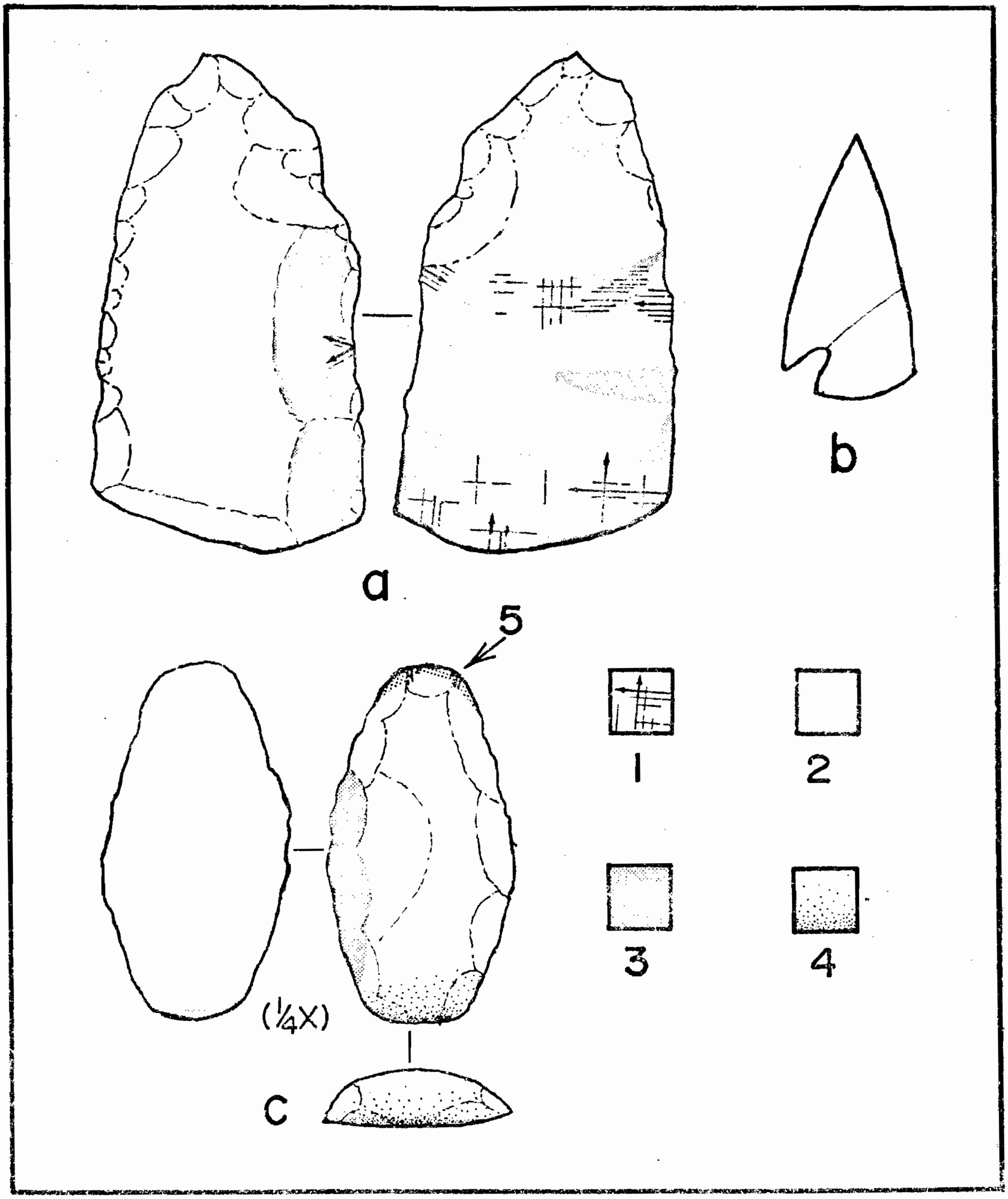

Fig. 23. Miscellaneous tools from Hogup Cave. a, worn uniface (chert); b, incipient corner-notched point (obsidian); c, gold-flecked hide-scraper/chopper (chert). 1, problematical striae; 2, surface polish; 3, edge and margin abrasion; 4, "gold" flecks; 5, hide scraping edge abrasion, polish and christie striae. (a) and (b) actual size.

Gold-flecked Hide-scraper/Chopper

No. of specimens: 1

Illustrative example: Fig. 23c

Morphological features:

Celt-like, with a generally ovoid outline

Plano-convex in cross section

Unifacial percussion flaked

Wear characteristics:

Hide-scraping edge polish and striae on the poll end

Light edge polish on the ventral side of the bit end

Light edge abrasion with no evidence of heavy battering on the margin of the bit end

Light abrasion of the ventral-lateral margin

Gold colored, metalic-like flecks concentrated toward the bit end of the dorsal artifact surface

Interpreted use: The poll end of this unusual tool was undoubtedly used to scrape animal skins, while the opposite end was used for some completely enigmatic light percussion activity.

Comments: The gold colored flecks are very shiny and cannot be removed from the stone surface. They do not appear to be the result of any known post-recovery operation, nor are they natural to the rock itself. Steel objects will impart similar metalic "silver" blemishes to this surface.

Incipient Corner-notched Point

No. of specimens: 1

Illustrative example: Fig. 23b

Morphological features:

Sub-triangular shaped projectile point with a single corner notch

Broken from the apex of this notch across the blade to the opposite edge

Wear characteristics: None

Interpreted use: This projectile point was apparently broken in the process of notching and discarded without being subjected to wear of any kind.

Comments: This piece was classified as a "single tanged projectile point" in the original report, but the striking absence of all forms of diagnostic or nondiagnostic surface and edge wear clearly indicates that is was broken in the process of manufacture, and not by use-impact.

Battered Bifaces

No. of specimens: 6

Illustrative examples: Fig. 24a,b,c

Morphological features:

Generally ovoid in outline

Blunt ends

Bifacially flaked by percussion

Wear characteristics:

Battered and dulled on the edge and adjacent margin of

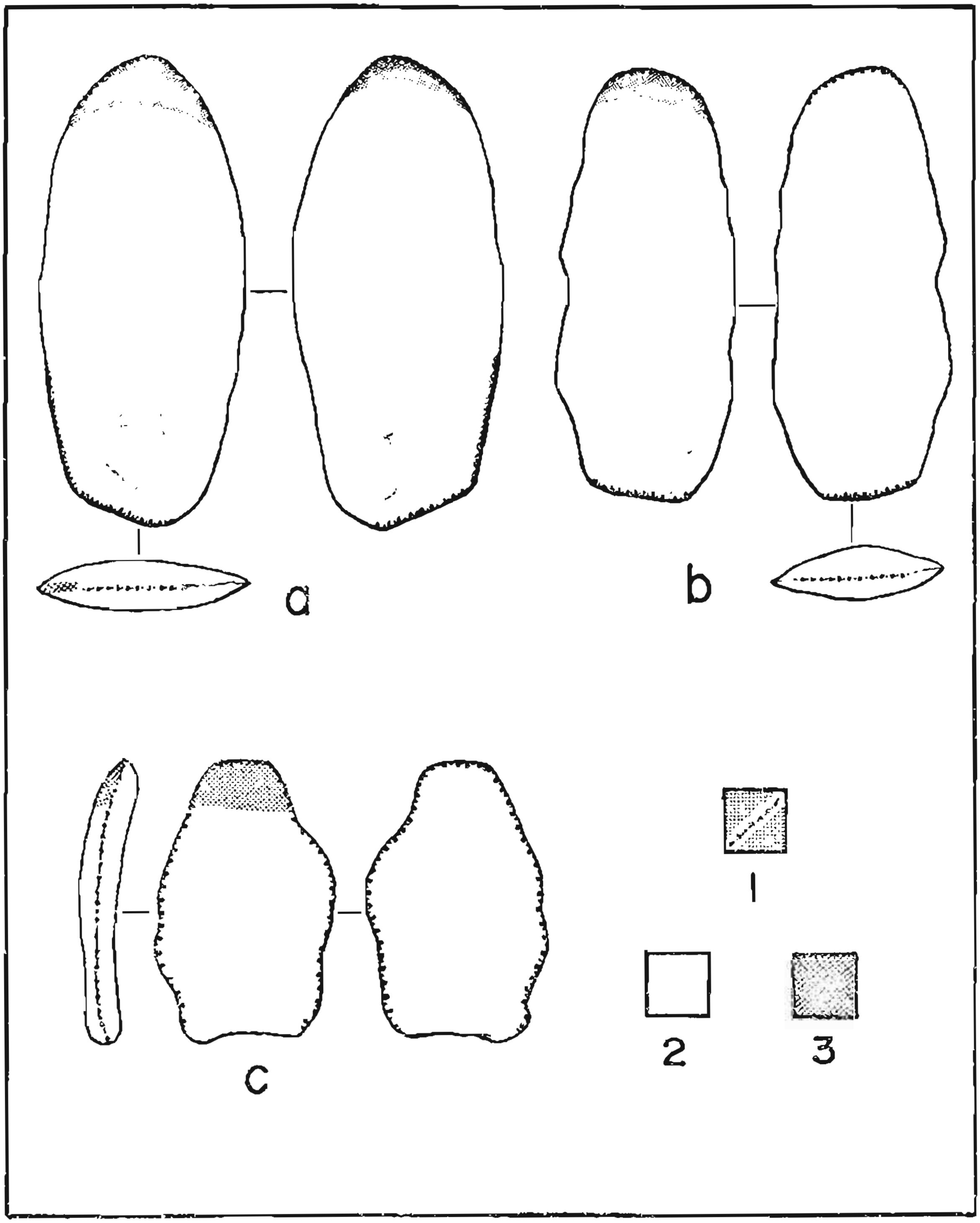

Fig. 24. Battered bifaces from Hogup Cave. a and b, chert; c, obsidian. 1, battered edge and margin; 2, hafting polish; 3, ground edge. All specimens actual size.

one end

Edge grinding (less common)

Hafting polish

Interpreted use: The precise function of these tools is uncertain. They were apparently hafted and used as percussion instruments against some unknown material.

CHAPTER 8

DISCUSSION

Edge Angles and Functional Activities

There has been much speculation about the relationship between tool edge angles and the functional activities of aboriginal tool kits. Recent microscopic and statistical studies with Paleo-Indian collections (Wilmsen 1968) and Australian ethnographic materials (Gould, Kostes and Sontz 1971) have begun to seriously consider the precise nature of these relationships. It is not expected that a correlation between working edge angle and tool activity will be found that is universally applicable and 100 per cent accurate, but these and other studies suggest that general correspondences can and will be discovered for particular collections or regional adaptations. Moreover, initial comparisons of the Hogup Cave results with Australian ethnographic data indicate that with more and better documented data from archaeological, ethnographic, and experimental sources, some cross-cultural generalizations may be possible in the future.

The discovery and documentation of such edge angle-functional relationships is the same for all sources of data: first, the functions of the tool kit are identified, either by interpretation of microwear, or by direct laboratory or field observation, and then the working edge angles are measured. By plotting the distribution of the angles for each activity, as in Fig. 25, the character of the relationship may be conveniently observed and studied.

Perhaps the first fact to be noticed in Fig. 25 is that the distributions of each of the five functional categories from the Hogup Cave materials are of unequal height and shape, and are located at different points along the horizontal axis. The wider the base of each peak or mode, the greater the range of edge angles associated with that particular function, whereas the locus of each peak represents the most typical edge angle value. This latter point is perhaps the most important because without appreciable separation between these different distributions, differentiation of functional types on the basis of edge angle would not be possible. As it is now, and even with considerable overlapping, there is only a very small portion of the tool sample (60°-75°) with edge angles which could serve for all five activities. Thus, for this collection it is possible to identify or define tool function in terms of the acuteness of the tool edge. The mean working edge values for each functional activity are:

Sawing 47°

Carving 48°

Soft scraping 68°

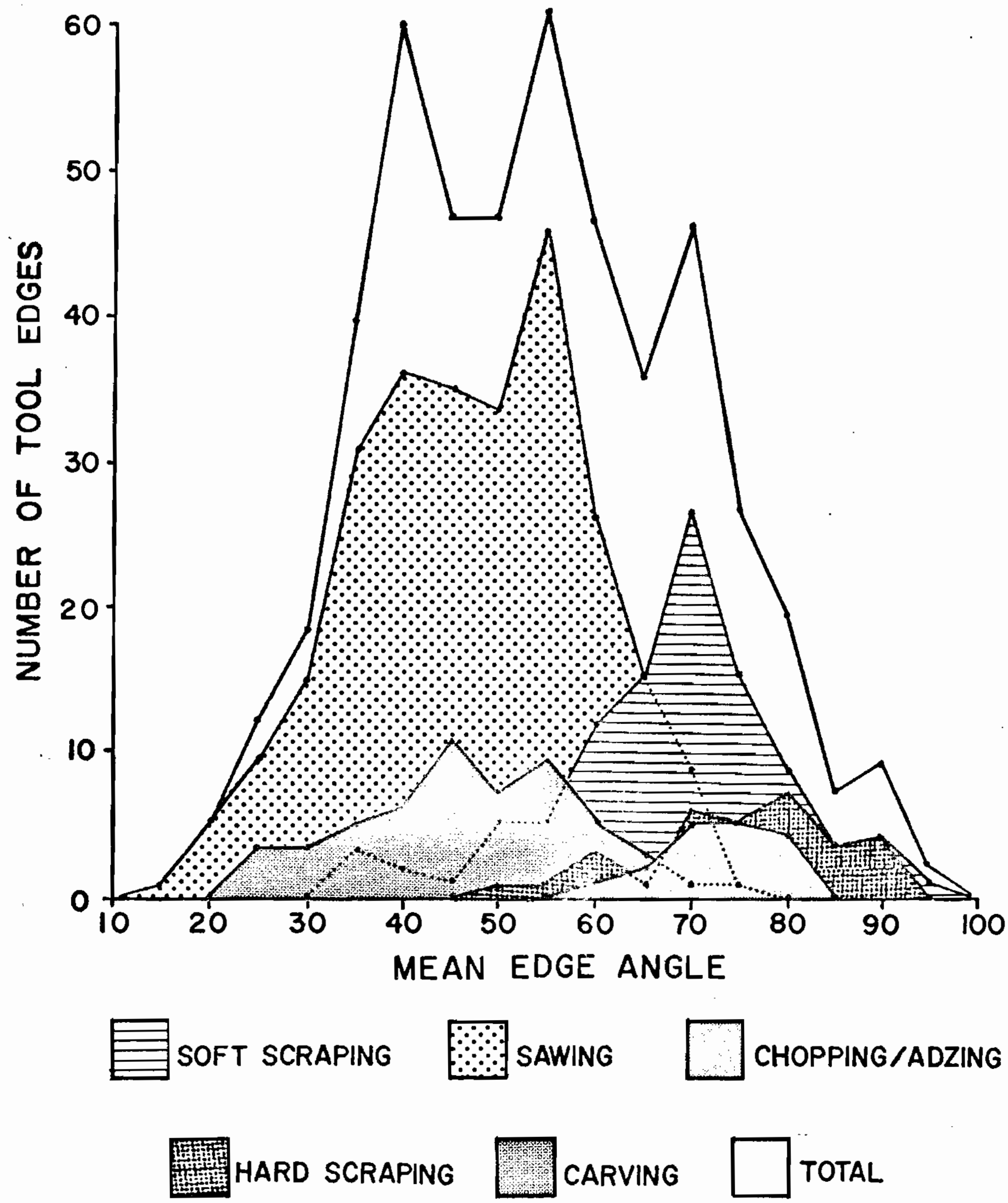

Fig. 25. The distributions of tool edge angle size for each of the 5 major functions identified in the Hogup Cave chipped stone tool sample.

Chopping and Adzing 73°

Hard scraping 75°

By this simple comparison it is clear that cutting tasks generally require the most acute angles, and percussion and hard scraping the steepest edges.

The difference between cutting and percussion values is interesting because it conforms to the tool pattern reported by Gould, Kostes and Sontz (1971) for two groups of Australian aborigines. In their study they noted that simple flake knives have mean working edge angles of 35° and 39°, whereas flake adzes exhibit average angles of 75° and 67°. These results are not perfectly duplicated in the Hogup sample, but the general pattern is similar, and the differences in cutting tool edge angles are undoubtedly due to the typically unmodified (and thus more acute) nature of the Australian flake knives. The congruency is, therefore, encouraging and suggests that further cross-cultural comparisons may be worthwhile.

The relatively narrow and steep distribution of soft scraping in the Hogup sample may be indicative of a selection for a narrow range of edge angles between 60°-80°. Hard scraping and carving tasks, on the other hand, appear to be satisfied by a much wider range of possible working angles. The distinctive bimodal distribution for both sawing and carving tasks can probably be explained by the fact that a large percentage of these categories is composed of projectile points and bifacial blade tool forms which, because of their statistical weight and contrasting edge character, tend to bifurcate the distribution.

Lithic Materials and Functional Activities

If all other variables, such as availability, aesthetics and religious/totemic criteria were held constant, the selection and utilization of different stone types would probably be solely dependent on the nature of the particular tasks to be performed, job requirements being matched with the known properties or capabilities of different stone types and tool edge angles. Some of the basic characteristics of lithic materials have already been discussed (Fig. 1). To repeat briefly, the vitreous types (obsidian and ignimbrite) are sharp but very brittle and easily abraded, while the crypto-crystalline quartz types (chert and chalcedony) are durable but not quite as sharp and slightly more difficult to work.

Fig. 26 demonstrates that some discriminating mechanism is at work in the choice of stone materials for different technological tasks. Soft scraping activities, for instance, favor chert, apparently for its abrasion-resistant qualities. Likewise, chopping and adzing, drilling, and awling tasks also require a durable chert edge capable of withstanding considerable abuse. For the majority of hard scraping and cutting functions, however,

LITHIC TYPE / FUNCTIONAL ACTIVITIES	CHERT	CHALCEDONY	OBSIDIAN	IGNIMBRITE	OTHER	
SOFT SCRAPING	72	10	-	5	13	100%
HARD SCRAPING	35	3	19	41	3	100%
SAWING	35	3	14	41	7	100%
CARVING	7	2	20	68	3	100%
TOTAL CUTTING	30	3	15	45	7	100%
CHOPPING and ADZING	65	15	12	8	-	100%
DRILLING	100	-	-	-	-	100%
AWLING	100	-	-	-	-	100%

Fig. 26. The correlation of lithic type and tool function in the Hogup Cave sample.

tools made of ignimbrite and obsidian are sought, although in each case one-third of the implements are of chert. For heavy-duty sawing and scraping activities such as the cutting of bone or antler, chert may have been used where the more brittle, vitreous types could not stand up.

These data, however, are only a part of the total pattern of lithic selection and utilization. A preference for a particular stone type in certain function situations does not necessarily mean that tools of that substance are used predominantly for that function. It is necessary to consider not only the stone types characteristic of each functional activity (as in Fig. 26), but also the range of activities characteristic of each lithic type. Fig. 27 fulfills this requirement by comparing edge angles of different lithic materials. The functional identifications are achieved by referring back to Fig. 25, and not by direct observation of tool microwear, because in too many cases the microwear data is distorted or unavailable (especially for certain lithic types such as chert and chalcedony).

Chert

Implements of chert are typified by two sets of working edge angles, 50°-60° and 70°-80°. This distribution suggests that chert tools were utilized primarily for cutting tasks, and secondarily for soft scraping or percussion.

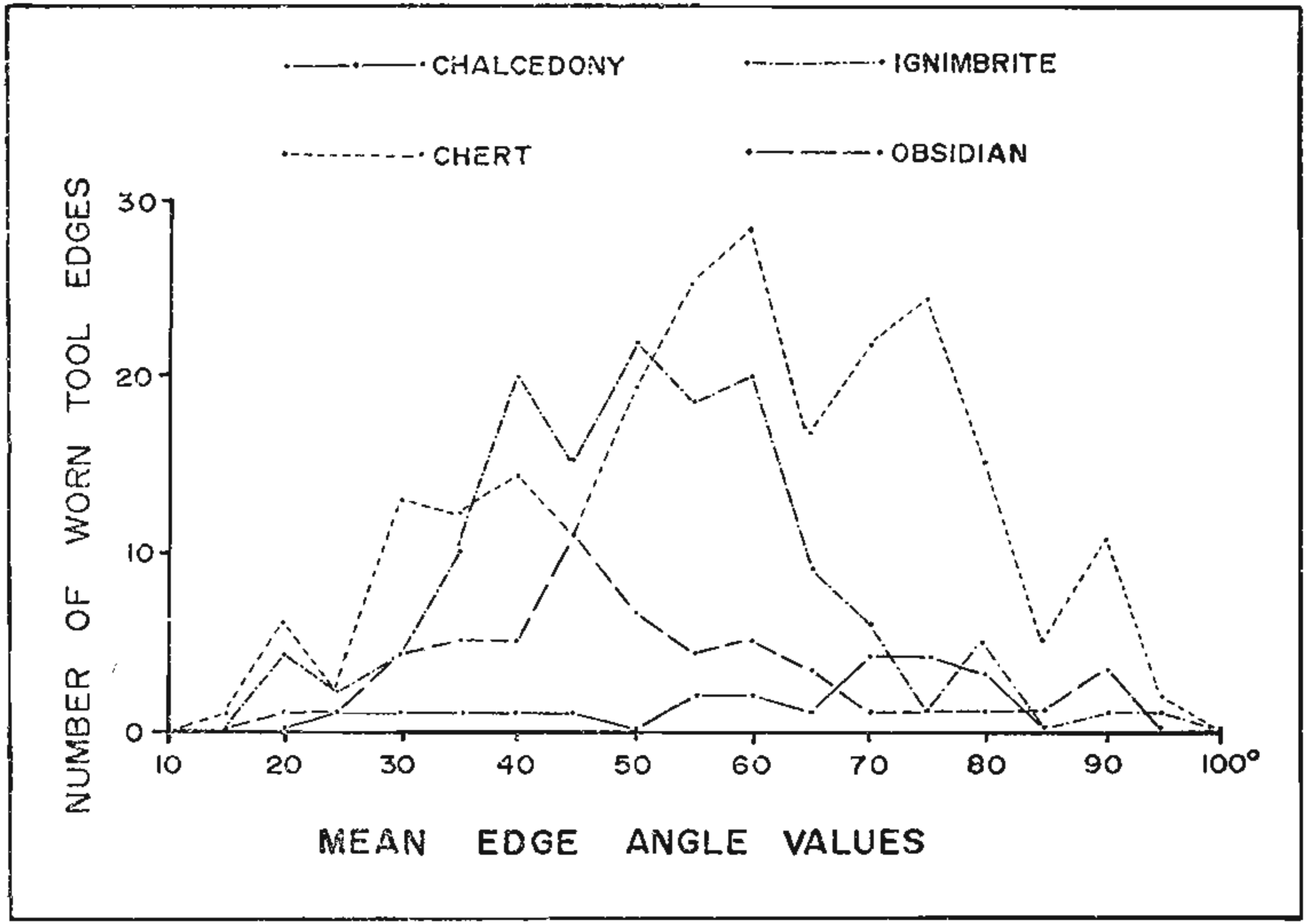

Fig. 27. The edge angle distributions of four lithic types in the Hogup Cave sample.

Ignimbrite

The edge angle sizes for ignimbrite tools cluster between 40°-60°, which indicates that implements composed of this material were employed mainly for cutting purposes.

Chalcedony

The most common edge angles for chalcedony tools are between 70°-80°, indicating that they were used for percussion, soft scraping and/or hard scraping.

Obsidian

Obsidian tools are characterized by a relatively wide range of working edge angles between 30°-60°, with a maximum peak at 40°, suggesting that very little except cutting functions were performed by most implements manufactured of obsidian.

Functional and Traditional Approaches to Tool Classification

The Hogup Cave chipped stone tools were originally classified on the basis of morphology and intuited function. The named types are illustrative of this point; some rely purely on morphological criteria ("Biface Blades"), implied function ("Drills"), or a combination of these criteria ("Side-scrapers").

Although it is not the intent of the present study to single cut the Hogup Cave report for special criticism-- as it is merely representative of the usual approach to artifact typology-- it can be shown that such a method involves pitfalls and potential misrepresentation. This is not to say that functional typology should replace the traditional method, but rather than a <u>blend</u> of functional and descriptive criteria would provide a more complete view of chipped stone materials.

As demonstrated by Fig. 28, a classification relying solely upon morphological and intuited use is less meaningful than a functional use-criteria classification. In this figure the same tools are classified by both methods and the results tabulated. Although similar in many areas, there are some striking inconsistencies between functional and morphological classifications. Perhaps the reason for these differences is that the descriptive system frequently overemphasizes or misinterprets certain tool characteristics. This can easily result in misleading and inaccurate tool names such as "side-scrapers", for tools which are frequently neither scrapers nor end-utilized instruments; "domed scrapers", which can just as easily be used as adzes; or "giant points", which are not projectiles at all but rather hafted wood saws (Hogup Saws). Another interesting point which is missed in traditional classification is the frequent multiplicity of tool functions, especially the use of projectile points as saws and knives.

Traditional Types \ Functional Types		Awling	Drilling	Soft Scraping	Hard Scraping	Cutting	Chopping/Adzing	Misc. or Unknown	No. of Specimens Examined	Unutilized (no micrower)	Utilized, but not as classification suggests
SCRAPERS	END-	-	-	38	2	16	4	1	50	7	6
	SIDE-	-	-	21	6	30	-	-	47	4	32
	OVATE-	-	-	11	2	5	1	-	16	2	2
	LARGE and SMALL DOMED-	-	-	8	2	2	10	-	27	6	11
	LARGE OVATE and CIRCULAR DOMED-	-	-	2	-	-	3	-	4	-	2
	HAFTED END-	-	-	1	-	-	-	-	2	1	-
	END SCRAPER/GRAVER	-	-	2	-	1	-	-	1	-	1
	SCRAPER FRAGMENTS	-	-	20	-	12	2	-	41	13	8
MISC.	BIFACE BLADES	-	-	4	-	44	1	-	71	24	-
	CRUDE UNI- & BIFACES	-	-	3	1	29	3	10	87	43	-
	SPOKESHAVES	-	-	-	2	2	-	-	2	-	-
	DRILLS	1	3	-	-	-	-	-	20	15	-
	GRAVERS	-	-	-	-	-	-	-	1	1	-
	OVATE CHOPPERS	-	-	1	-	-	1	1	3	-	2
	UTILIZED FLAKES	-	-	12	18	51	-	9	100	27	-
	UNUTILIZED FLAKES	-	-	-	1	17	-	2	100	80	-
PROJECTILE TYPES	ELKO SERIES	-	-	-	5	55	-	-	158	103	-
	BITTERROOT SERIES	-	-	-	-	13	-	-	21	8	-
	BLACKROCK CONCAVE BASE	-	-	-	-	7	-	-	16	9	-
	HUMBOLDT CONCAVE BASE	-	-	-	-	11	-	-	18	7	-
	PINTO SERIES	-	-	-	-	8	-	-	31	23	-
	LAKE MOHAVE	-	-	-	-	-	-	-	1	1	-
	SILVER LAKE	-	-	-	-	-	-	-	1	1	-
	ROSE SPRING SIDE NOTCHED	-	-	-	-	3	-	-	33	30	-
	COTTONWOOD TRIANGULAR	-	-	-	-	-	-	-	11	11	-
	EASTGATE EXPANDING STEM	-	-	-	-	-	-	-	18	18	-
	DESERT SIDE NOTCHED	-	-	-	-	-	-	-	3	3	-
	STEMMED INDENTED BASE	-	-	-	-	-	-	-	2	2	-
	GIANT POINTS	-	-	-	-	6	-	-	7	1	6
	BIPOINTS	-	-	-	-	2	-	-	2	-	2
	CORNER TANGED	-	-	-	-	1	-	-	1	-	1
	SCOTTSBLUFF	-	-	-	-	1	-	-	1	-	1

Fig. 28. A comparison of functional and traditional approaches to the classification of Hogup Cave chipped stone tools.

CHAPTER 9

SUMMARY AND CONCLUSIONS

A sample of 1,000 chipped stone tools from Hogup Cave, northwestern Utah, were microscopically examined for evidence of use-wear. Many were shown to exhibit microwear similar to that described for European Upper Paleolithic and American Paleo-Indian tool kits. Functional interpretation of these features was accomplished mainly through comparison with experimentally produced wear patterns on similar tools of known function.

Nine categories of functional activity were identified for the Hogup Cave sample. These include hard scraping (wood and bone), soft scraping (hide), carving (wood and perhaps meat), sawing (wood and bone), chopping and adzing (wood), projectile impact (hunting), drilling (wood), and awling (hide). Sawing, soft scraping and carving appear to be the most common technological activities at the site, but this picture may be partially artificial due to the differential wear production and distorted "visibility" of certain activities in the archaeological record.

A tentative functional typology based on microwear and descriptive criteria is offered in an attempt to add a new dimension to the traditional view of artifact classification. In this typology 13 basic functional types are suggested and defined, including Simple Projectile Points, Projectile Saw/Knives, Flake Saw/Knives, Biface-blade Saw/Knives, Flake Hide-scrapers, Hide-scraper/Saws, Hogup Saws, Choppers, and Awl/perforators. Several miscellaneous types are also presented. Seventy-four (74) per cent of the 1,000 sample artifacts analyzed can be conveniently categorized by this system, and the remainder (252) are without wear or are nondiagnostic with respect to form or function.

Conclusions

From the analysis of the Hogup Cave materials the following conclusions are drawn:

(1) Distinctive microwear can be observed and functionally identified on a variety of Great Basin chipped stone tools.

(2) Flake edge retouch is not necessarily indicative of a working margin, but can be the result of tool backing or shaping techniques only indirectly related to tool function.

(3) Flakes retouched along one side are more likely to be cutting tools than "side-scrapers".

(4) Flakes worked unifacially to form a steep, arcuate margin on one end were usually used as end-scrapers for the cleaning of animal skins.

(5) Most types of projectile points were also used as cutting implements (usually saws), and some were probably employed

<u>exclusively</u> for cutting tasks.

(6) Many "waste" flakes are genuine tools.

(7) A single artifact was frequently used for a variety of functional purposes.

(8) Some wood and fiber working activities did not result in tool microwear. In these cases it is only the presence of preserved plant fibers on use-surfaces which permit functional identification. The identification of these and other organic residues on tool edges may, in the future, lead to more precise functional interpretations of some plant processing implements.

(9) Tool function cannot always be correctly inferred from stylistic criteria alone, and a system of tool classification based solely on morphology is less meaningful if functional criteria are not utilized.

BIBLIOGRAPHY

Aikens, C. Melvin
1970 Hogup Cave. University of Utah Anthropological Papers, No. 93.

Bordes, F.
1969 Reflections on typology and technology in the Paleolithic. Arctic Anthropology 6:1-29.

Condie, Kent C. and Alan B. Blaxland
1970 Sources of obsidian in Hogup and Danger Caves. Appendix IX. In Hogup Cave, University of Utah Anthropological Papers, No. 93, pp. 275-281.

Crabtree, D.E. and E.L. Davis
1968 Experimental manufacture of wooden implements with tools of flaked stone. Science 159:426-428.

Epstein, George C.
1963 The burin-faceted projectile point. American Antiquity 29:187-201.

Frison, George C.
1968 A functional analysis of certain chipped stone tools. American Antiquity 33:149-155.

Fry, Gary F.
1970 Ecological adjustment as reflected by an analysis of coprolites from Utah. Paper presented at the 1970 meeting of the American Anthropological Association, San Diego, California.

Goodman, Mary Ellen
1944 The physical properties of stone tool materials. American Antiquity 9:415-433.

Gould, Richard, Dorthy Kostes and Ann Sontz
1971 The lithic assemblage of the Western Desert Aborigines of Australia. American Antiquity 36:149-169.

Hester, T.R.
1970 A study of wear patterns on hafted and unhafted bifaces from two Nevada caves. University of California Archaeological Research Facility, Contributions 7:44-54.

Hester, T.R. and R.F. Heizer
1972 Problems in the functional interpretation of artifacts: scraper planes from Mitla and Yagul, Oaxaca. University of California Archaeological Research Facility, Contributions 14:107-123.

Hester, T.R. and R.F. Heizer
1973 Arrow points or knives: comments on the proposed function of "Stockton Points". American Antiquity 38:220-221.

Muto, Guy
1971 A stage analysis of the manufacture of stone tools. In, C. Melvin Aikens (ed.) Great Basin Anthropological Conference 1970: Selected Papers. University of Oregon Anthropological Papers, No. 1, pp. 109-118.

Nance, J.D.
1971 Functional interpretations from microscopic analysis. American Antiquity 36:361-363.

Rovner, Irwin
1971 Potential of opal phytoliths for use in paleo-ecological reconstruction. Quartenary Research 1:343-359.

Semenov, S.A.
1964 Prehistoric Technology. Barns and Nobel, New York.

Sheets, Payson D.
1973 Edge abrasion during biface manufacture. American Antiquity 38:215-218.

Thompson, M.W.(translator)
1964 Preface in Prehistoric Technology by S.A. Semenov, pp. ix-xii.

Twiss, P.C., Erwin Suess and R.M. Smith
1969 Morphological classification of grass phytoliths. Proceedings of the Soil Science Society of America, 33:109-115.

Wilmsen, Edwin N.
1968 Functional analysis of flaked stone artifacts. American Antiquity 33:156-161.

Witthoft, J.
1967 Glazed polish on flint tools. American Antiquity 32:383-388.

Wylie, Henry G.
1970 Archaeological reconnaissance of northwestern Utah and northeastern Nevada. Report submitted to the Archaeology Laboratory, University of Utah (xeroxed).

1973 Some functional tool types from Hogup Cave, Utah. Paper presented at the 1973 Meeting of the Society for American Archaeology, San Francisco, California.

APPENDIX I

MICROANALYSIS ARTIFACT DATA SHEET

Morphological Type:

Material/color:

Specimen No.:

Further Analysis:

Location:

Photo:

needed-

taken-

Site:

Sketch:

Measurements: thickness-
edge angle-

Discussion: residues-
retouch-
intensity-
slide prepared-
slide observation-

Functional Type: